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AUTHOR Horder, Alan
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ABSTRACT

This document details the creation and development of a small-scale microfiche production unit in the Matheson Library of the Papua New Guinea University of Technology. Emphasized are the technical aspects of developing the unit, especially in a developing nation. Specifications for equipment are provided, and production procedures are detailed. Quality control and problems encountered are described. Appendixes include a timetable of the project, a list of suppliers, and a proposal for accommodations and staffing for the project. A sample of the microfiche produced by the unit is included in the original printed document. (17 references) (EW)

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SETTING UP AND RUNNING A MICROFICHE PRODUCTION UNIT IN A DEVELOPING COUNTRY

A CASE STUDY

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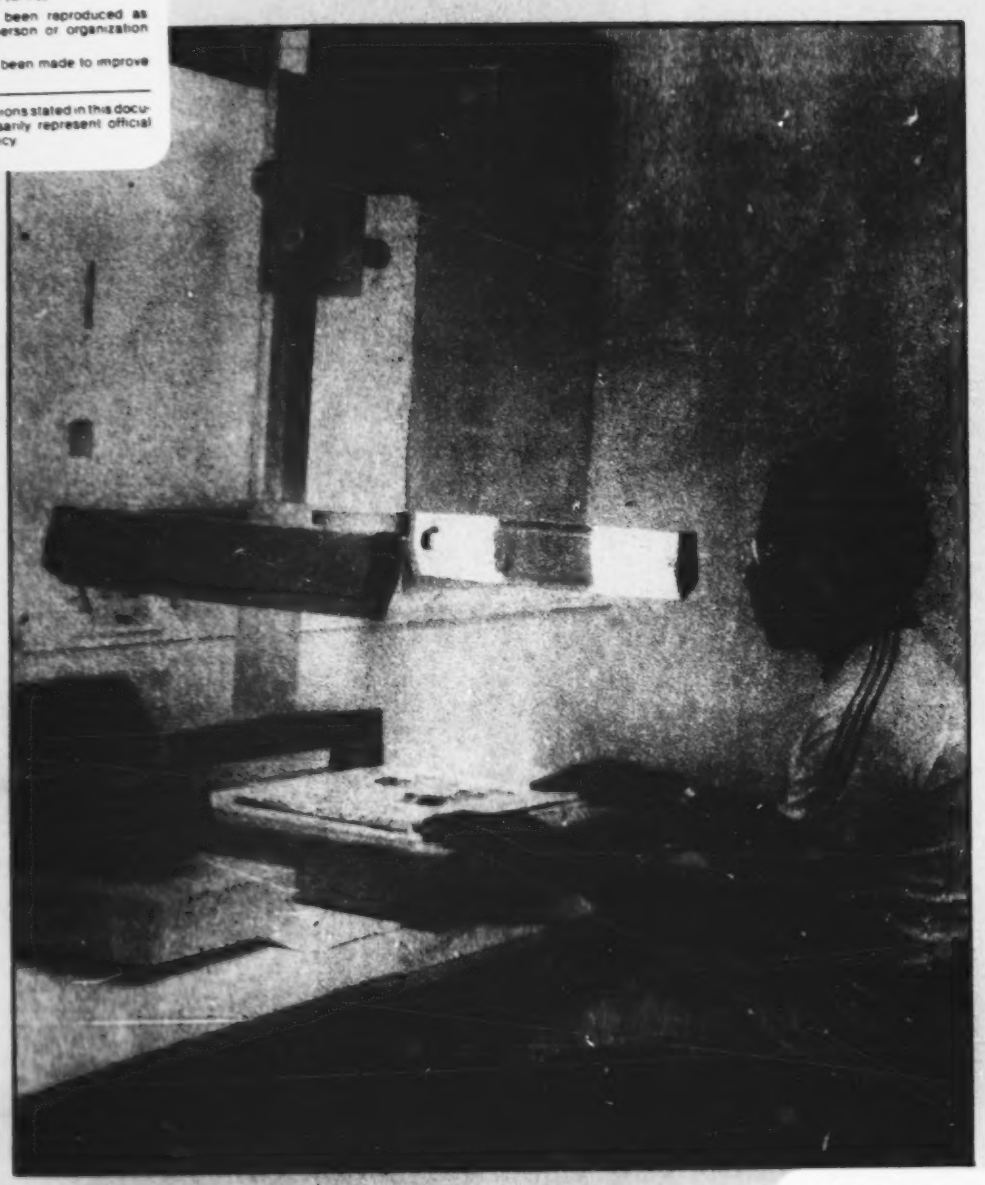

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SETTING UP A SMALL-SCALE MICROFICHE PRODUCTION UNIT IN A DEVELOPING COUNTRY: A CASE HISTORY

Alan Horder

October 1987

The Matheson Library,
The Papua New Guinea University of Technology,
Private Mail Bag,
Lae,
Papua New Guinea

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ABSTRACT

A detailed account is given of a project involving the setting up and running of a small-scale microfiche production unit in a University Library in Papua New Guinea. The progress of the project is described from its inception in 1982 to a point where it was well-established four years later. The emphasis in the study is on technical aspects of microfiche production in a pioneering situation in a developing country.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the cooperation of all the members of staff of the Matheson Library that made the project possible, in particular that of the University Librarian Mr.S.A.Patchett who originated the project, the Serials Librarian Mrs.M.A.Kennan, and the Papua New Guinea Collection Librarian Mr.D.Temu. He would like too to thank the two Library Assistants (Microfilm), Mrs.F.Kamouda and Mr.P.Nagai, for their hard work and forbearance when things at times went wrong.

He would like to acknowledge the help of the several members of the staff of the Audio Visual Unit who assisted with the project from time to time, and the help of staff from many other Departments of the University - without whose cooperation the project would not have been possible. The photographs of the project at the end of the report were taken by Mr.K.Taho of the Audio Visual Unit.

He is also grateful to Mr.R.N.Broadhurst of Cimtech - the National Centre for Information Media and Technology (formerly NRCd - National Reprographic Centre for documentation), Hatfield, United Kingdom, for his generous help over a number of years in responding to queries raised by the author in correspondence.

CONTENTS

	Page
1. INTRODUCTION	1
2. MICROFICHE PRODUCTION METHOD AND FORMAT ADOPTED	5
3. EQUIPMENT	10
4. ACCOMMODATION AND FURNITURE	17
5. CONSUMABLES	20
6. STAFFING	26
7. PRODUCTION PROCEDURES FOLLOWED	28
1. Filming	28
2. Film processing	31
3. Film inspection	34
4. Titling the microfilm jackets	35
5. Jacketing	36
6. Microfiche duplication	36
7. Microfiche distribution and storage of masters	38
8. QUALITY CONTROL	40
9. WORK COMPLETED	43
10. PROBLEMS ENCOUNTERED	45
1. General	45
2. Equipment	46
3. Film scratching	46
4. Exposure control	47
5. Exposure of newspapers	48
6. Filming thick publications	49
REFERENCES	50
APPENDICES	
1. Timetable of the project	52
2. Names and addresses of suppliers of equipment and materials	55
3. Proposed accommodation and staffing for microfiche production, May 1984	57

APPENDICES (continued) Page

4. Operations proposed to be carried out and furniture required in Discussion Room No. 2, May 1984 58

5. Discussion Room No. 2 - proposed layout for microfiche production, May 1984 59

6. Layout of microfiche production equipment in workroom area of Audio Visual Unit 60

7. Production record form used in the project 61

8. Target preceding document filmed at reduction ratio of 21X 62

9. Target following document 63

10. Target at end of microfiche continued on a further microfiche 64

11. Microfilming procedure (notice posted alongside Minolta Micro Auto 16 Camera) 65

12. Operation of processor (notice posted alongside Bray 16/35 Microfilm Processor) 66

13. Processing solutions (notice posted alongside Bray 16/35 Microfilm Processor) 68

14. Record showing use of processing solutions (notice posted alongside Bray 16/35 Processor) 69

15. Quality control record form used in the project 70

16. Kodak Process Record Form No.Y-55 as used for monitoring camera and film processor performance 71

17. Photographs of the project 72

INSIDE BACK COVER

Example of microfiche produced in the project

SECTION 1

INTRODUCTION

Background to the project

One of the problems of any University Library is the preservation for future use of its periodicals collection. The Matheson Library of the Papua New Guinea University of Technology had planned to establish a library bindery to alleviate this problem, but staff cuts imposed on the University in 1982 made it impossible to proceed with this.

For most of the periodicals published overseas which the Library receives the loss of the bindery was not a major problem, since microfilm back files of such periodicals are commercially available and cost no more per volume than in-house binding - while conserving shelf space. With limited exceptions, however, periodicals published in Papua New Guinea are not available from commercial microform publishers, and are unlikely to become available. For these periodicals the loss of the bindery created a serious problem because such periodicals are very heavily used, are subject to considerable mutilation and loss and are extremely difficult to replace.

In view of this, and bearing in mind the experience and capability for photographic work (of which micrographic production is a variant) of the University Audio Visual Unit - which forms part of the Library - the University Librarian proposed in 1982 that the Library should acquire the capacity to produce for itself, and for other libraries in Papua New Guinea, microfiche reproductions of periodicals issues.

He considered that, in addition to solving the Library's preservation problem and alleviating the space pressure which large periodical backfiles would create in the Library in five to six years, the establishment of an in-house microfiche production unit offered significant advantages for the University:

a. a further fostering of goodwill and respect for the University's ability to meet the needs of other educational institutions and libraries in the country;

b. recoupment of the costs of reproducing Papua New Guinea periodicals back files through sales of duplicate microfiche to, e.g., the University of Papua New Guinea (including Goroka Teachers College), National Library Service, Papua New Guinea Institute of Applied Social and Educational Research and other libraries;

c. income from microfiche production for institutions other than libraries.

Background of the author

Following a career of some thirty-five years in technical areas of photography, in recent years specialising as a microfilm consultant, the author in September 1981 took early retirement from his post as Research Officer at the National Reprographic Centre for documentation (NRCd), Hatfield, United Kingdom. From October 1981 to July 1983 he worked as a short-term assistant in the Printing Department of the Papua New Guinea Branch of the Summer Institute of Linguistics, at its Ukarumpa Centre. His duties there included the setting up of a small microfiche production facility with the primary objective of making a backlog of linguistic manuscripts more readily available (ref. 1).

For the six-month period from May to October 1982 the author was released by the Summer Institute of Linguistics (SIL) to work as temporary Audio Visual Officer in the Matheson Library on a part-time basis, to fill a vacancy which had arisen as a result of the previous occupant of the post leaving before completion of his contract.

In October 1983 the author returned to the University to take up the post of Audio Visual Officer on a full-time basis for a three-year period.

Equipment for the project

The University Librarian took advantage of the presence of the author in Lae in mid-1982 to discuss the microfiche production unit project with him. Following this, the author drew up a list of a minimum range of equipment that would enable the Library to undertake all the operations involved in the production of microfiche masters and duplicates. This formed the basis for a Supplementary Request for Audio Visual Capital Funds, prepared by the University Librarian in September 1982, which was subsequently approved by the University Budget Planning Sub-Committee.

Staffing for the project

The University Librarian initially envisaged that the project would require the following staff:

No.	*Post*	*Source*	*Duration*
1	Microform Adviser	Overseas Agency	12 months
1	Technical Assistant for microfiche production	Matheson Library (to be assigned to existing post on establishment)	Permanent

The author indicated his willingness to serve as Microform Adviser on the project following completion of his work with the Summer Institute of Linguistics. Attempts to obtain funding for this post were made but no success had been achieved by the time when, in June 1983, the author was offered and accepted the post of Audio Visual Officer in the Matheson Library on a full-time basis for a three-year period. It was envisaged that in this post he would additionally be able to act as Microform Adviser for the microfiche production unit project.

The literature

A number of publications deal with the setting up of a microfilm unit serving the needs of a developing country, although some of these are now somewhat dated. A brief manual, "Microphotography for Archives", first published by the International Council for Archives (ICA) in 1968, has for some years served as a useful introduction to the subject for archivists, but is concerned more with the production of 35mm roll microfilm than with microfiche (ref. 2). This manual was subsequently expanded and republished by the ICA, in cooperation with Unesco, in 1973, with the title "A study of the basic standards for equipping, maintaining and operating a reprographic laboratory in archives of developing countries" (ref. 3).

More recently, a report was prepared by the ICA, under contract to Unesco, entitled "Planning, equipping and staffing a document reprographic service: A RAMP study with guidelines". (RAMP in this context stands for a Unesco "Records and Archives Management Programme".) This report, published in 1984 (ref. 4), deals with the production of both microforms and hard copy and is written with the problems of developing countries in mind - especially those in tropical areas. It is a more detailed report than either of its predecessors, and, although like them it is more concerned with the production of roll microfilm than with microfiche, it contains recommendations that have wide application.

One of the authors of the Unesco RAMP study has written in general terms about microphotography in developing countries in the International Journal of Archives (ref. 5).

Although not written with the needs of developing countries especially in mind, attention may also be drawn to a recently published British Standard Guide to setting up and maintaining micrographics units (ref. 6).

The author has written in general terms about the project which is the subject of this study elsewhere (ref. 7); the purpose of the present report is to provide a more detailed account. In a situation where staff changes are frequent, it seemed important to place on record what actually took place in the early years of one particular project involving the setting up of a microfilm unit, the goals of the project and the reasons why certain things were done in a certain way.

It is hoped that such an account will, in the first place, be of assistance to the author's successor as supervisor of the project, to the University Librarian, and to others with varying degrees of involvement with the project. Secondly, it is hoped that the study will be of interest (and of help - if only as a check list) to others - outside the University - facing the same problem that the author faced in Lae in 1983: namely, that of setting up a microfiche production unit in a developing country.

A timetable of the project is given in Appendix 1 at the end of the report, and photographs illustrating some of the practical operations involved are reproduced in Appendix 17. An example of the microfiche produced in the project is attached to the inside of the back cover of the report.

SECTION 2

MICROFICHE PRODUCTION METHOD AND FORMAT ADOPTED

Microfiche are produced either by filming documents already existing in paper form or by imaging the output of a computer directly on to film without any intermediate paper stage. Microfiche produced in the first way are sometimes termed "source document microfiche"; microfiche produced in the second way are called "computer output microfiche" - usually abbreviated to "COM". COM microfiche are widely used in financial institutions and in libraries. The catalogue of books added to the Matheson Library since the beginning of 1983 is produced in the form of COM microfiche. In the project for the microfilming of Papua New Guinea periodicals, however, we are concerned with source document microfiche.

Two main methods for the production of source document microfiche are in general use, as follows:

1. by using a step-and-repeat camera to expose directly onto sheet film in the A6 (105mm x 148mm) size;
2. by "stripping up" 16mm roll film to form an array of images on an A6 sheet.

The widespread adoption of microfiche as a medium for the dissemination of information has necessitated and been facilitated by the adoption of standards covering, in particular, the size of the microfiche itself and the number and arrangement of the frames on the microfiche. The latter is usually referred to as the "format" of the microfiche. In the present application two formats - both the subject of national and international standards - needed to be taken into consideration, as follows:

1. *60-frame format: 5 rows of 12 frames each*
   The format naturally arrived at by producing microfiche by stripping up 16mm roll film. Still widely used for business records. (See ref. 8.)
2. *98-frame format: 7 rows of 14 frames each*
   Specially developed as a higher capacity format for the dissemination of official reports. Is readily produced using step-and-repeat cameras and has become the standard format for all large-scale micropublishing operations. Production of 98-frame format microfiche by stripping up 16mm roll film is more complex than producing 60-frame microfiche by this method, requiring the film to be slit to a narrower width before stripping up. (See ref. 9.)

In large micropublishing operations microfiche are produced almost exclusively by using step-and-repeat cameras, although this requires a considerable capital investment.

On the other hand, microfiche production by stripping up 16mm film can be commenced with a minimum of equipment and consequently with a smaller capital investment than when using a step-and-repeat camera. Use of a stripping-up method also has the advantage that the camera can, if required, be used for the production of film to be left as roll film. Microfiche production by stripping-up methods is, however, more labour-intensive than using a step-and-repeat camera.

A variety of methods are available for stripping up 16mm roll film for the production of microfiche. The method normally adopted for business records is to employ a microfilm jacket and to duplicate this onto diazo film. This procedure leads naturally to the production of microfiche in the 60-frame format. It is possible to produce 98-frame microfiche using microfilm jackets, but this requires the film to be slit to a narrower width and necessitates the use of a proprietary brand of jackets. Consequently, the 60-frame format remains the norm for business records.

The microfiche production facility set up by the author in the Technical Studies Department of the Summer Institute of Linguistics at Ukarumpa in 1981-3 was equipped to produce 98-frame microfiche by a proprietary stripping-up process called the "Molex" system. In this, exposed and processed 16mm roll film is first slit to a width of 12.3mm and then cut into 14-frame strips which are positioned by hand on a flexible transparent plastic sheet to which they adhere by molecular adhesion.

The Molex process was chosen for use at Ukarumpa because it had been employed successfully for a number of years in a microfiche production operation in the Academic Publications Department at the SIL International Linguistics Centre in Dallas, USA, where the 98-frame format was considered to be the only acceptable standard for microfiche intended as a medium for publication. The Molex process has the advantage over microfilm jackets that it yields slightly better image quality, since no layer of any kind comes between the camera film and any material on which it is duplicated. It has the advantage over the proprietary jackets marketed for producing 98-frame microfiche of yielding frames with slightly greater image height, since the Molex method requires 16mm film to be slit to a width of only 12.3mm, compared with the 11mm required by the proprietary (Comjac®) process.

In mid-1982, the author made a cursory examination of the shelved periodicals in the Matheson Library to gain some idea of the extent and nature of the material which it was desired to preserve in microform. At this point of time it appeared that the largest page size that would require to be filmed was foolscap (8in x 13in). Very little information about the number of titles that would require to be filmed

appeared to be available but it was concluded that by commencing with a single 16mm planetary camera it would be possible to make a useful start to the project and to gain experience. If the volume of work proved too great to be undertaken using a single camera a further camera (or cameras) could be installed later.

On the basis of this somewhat perfunctory consideration it was decided that the Matheson Libary should be equippped to produce microfiche by the Molex method and that the equipment purchased for the project should include a 16mm planetary camera of the same type as that employed by the Summer Institute of Linguistics at Ukarumpa (and at Dallas). It was recognized that the camera concerned made no provision for a book cradle to be fitted - as required when filming thick books and reports - but it was hoped that on the few occasions when the need to film thick documents arose it would be possible to improvise some form of device to hold them in position.

Production of 98-frame microfiche by the Molex method involves the following operations:

1. filming of the original documents on 16mm roll film;
2. processing of the camera film;
3. inspection of the processed film;
4. slitting of the processed film to a width of 12.3mm (by removing narrow strips of equal width from each edge);
5. stripping up the slit film onto clear plastic sheets to produce Molex masters;
6. titling the Molex masters;
7. production of distribution diazo duplicates from the Molex masters;
8. storage of the Molex masters under archival conditions.

It was decided to equip the Matheson Library with equipment to enable all of the above operations to be carried out, and details of the equipment selected for this work are given in the next section of this report.

In applications where large numbers of distribution diazo duplicates are to be produced, an additional operation may be required following operation 6, namely the production of intermediate diazo duplicates from the Molex masters for use as printing masters in operation 7, to save the Molex originals from unnecessary wear. It was not considered that the Matheson Library application required this additional step.

It was stated earlier that microfiche production using stripping-up techniques can be commenced with a smaller capital outlay than when using a step-and-repeat camera. This is true because the cameras employed for the former process are cheaper and because a number of operations -

in particular, film processing - can be contracted out to commercial laboratories. If, however, it is proposed to carry out locally all the operations involved in microfiche production the cost of equipment for production using stripping-up techniques is of the same order as that required for an operation using a simple step-and-repeat camera. Initial calculations made in connection with the Matheson Library project were as follows:

System based on use of stripping-up techniques (Molex system)	K14,200
System based on use of step-and-repeat camera (Aarque Systems 8000GC)	K15,000

Despite the closeness of these figures, however, use of a stripping-up method was still considered preferable, if only because it permitted 16mm roll microfilm to be produced - in addition to microfiche - a facility which it was thought would be of use to the University administration at some time in the future.

Although ordering of equipment began in October 1982, immediately following approval of funds for the project, it was not until April 1984 (six months after taking up the full-time post of Audio Visual Officer) that the author was able to devote time regularly to the project, and October 1984 before the main items of equipment had been installed.

At this point, in the light of first-hand experience with the Molex system at Ukarumpa, and of a better understanding of the nature of the materials requiring to be filmed in the Matheson Library, the author recommended a change in both the format to be adopted and the production method to be employed: namely that 60-frame microfilm jackets should be used as masters instead of 98-frame Molex microfiche.

The main reasons behind the proposal were on the one hand trouble experienced with self-adhesive Molex title strips which were found to "ooze" adhesive and adhere to one another, and on the other hand a growing realisation that among the most important Papua New Guinea serials requiring microfilming were A3-size newspapers which, with the camera selected, could be filmed on 60-frame microfiche but not on 98-frame microfiche - with their smaller frame size. Details of the equipment needed to effect this change in format and production method are given in the next section of the report.

As the project progressed it became apparent that it would be necessary to obtain additional equipment to provide a back-up for certain machines which had given trouble. Details of the equipment ordered for this purpose are included in the next section of the report.

In 1986, the University Librarian of the University of Papua New Guinea kindly made available to the Matheson Library, on long loan, two items of microfilm production equipment - a 16mm camera and a microfilm jacket reader-filler - for which there was no longer a need in Port Moresby. Details of this equipment also are included in the next section of the report.

SECTION 3

EQUIPMENT

In this section of the report details are given of the various items of equipment obtained for the project over the four-year period August 1982 - September 1986, together with the reasons for acquiring each item.

The prices given are those obtaining at the time each item was purchased and exclude any charges for packing, insurance and freight. Approximate exchange rates for the Papua New Guinea Kina (K) during the period covered were:

K1.00 = £0.70
A$1.30
US$1.10

When placing orders for electrical equipment, care was taken to ensure that the voltage (240V) and the frequency (50Hz) of the local power supply were stated. This was considered especially important when ordering from overseas.

All the heavier items of equipment from overseas were ordered for despatch by sea freight. This meant that delivery times were typically four months for goods shipped from Australia and six months for goods coming from the United Kingdom.

Addresses of suppliers are given in Appendix 2 at the end of the report.

1. Camera

Make and model:	Minolta Micro Auto 16 with Special Film Unit Series 1
Supplier:	Océ-Reprographics
Price:	A$2595
Date ordered:	October 1982

This camera was originally selected for the production of microfiche by the Molex method and is identical with that used by the Summer Institute of Linguistics in its operations at Dallas and at Ukarumpa. It permits the use of reduction ratios of 21X, 25X, 27X and 29X. The Special Film Unit Series 1 was chosen in order to obtain a frame advance (10mm) and frame size (9.75mm x 12.25mm) compatible with the 98-frame microfiche format.

The Minolta Micro Auto 16 is of a well-tried design and has been in widespread use worldwide for over 10 years. It is marketed by Bell & Howell as the Filemaster, and under this name was favourably evaluated by the National Reprographic Centre for documentation (NRCd) (ref. 10).

2. Film unit

Make and model:	Standard Film Unit for Minolta Micro Auto 16
Supplier:	Océ-Reprographics
Price:	A$1295
Date ordered:	November 1984

This unit was ordered immediately following the decision to change from the Molex process to the use of microfilm jackets for the production of microfiche masters (see page 8). It provides a frame advance (11.75mm) and a frame size (11mm x 15mm) compatible with the 60-frame microfiche format.

3. Camera

Make and model:	Bell & Howell Filemaster II
Supplier:	Information Technology Systems
Price:	K2480 (in 1981)
Date received:	June 1986

This camera was made available to the Matheson Library through the courtesy of the University Librarian of the University of Papua New Guinea, it being no longer required in the Michael Somare Library there. It was manufactured for Bell & Howell by Minolta but differs from the Micro Auto 16 camera in having two film units instead of one, enabling two copies of a microfilm to be produced at the same time. It differs also in the reduction ratios which it permits which are 26X and 31X only.

Each film unit of the Filemaster II provides a frame advance (11.75mm) and image size (9.6mm x 15mm) compatible with the 60-frame microfiche format, but the frame size is slightly narrower than that provided by the single-headed Micro Auto 16 Camera with Standard Film Unit. The film units of the twin-headed Filemaster II camera are not interchangeable with those of the single-headed Micro Auto 16.

The Filemaster II camera was not used for microfiche production during the period that the author was associated with the project, but it proved invaluable in 1986 in enabling production of roll microfilm to be undertaken for the University administration without interrupting the filming of periodicals then being undertaken on an almost continuous basis (retrospective filming of newspapers). For this work the camera was used as a single-headed camera, i.e., only one film unit was used.

4. Voltage stabiliser

Make and model:	Advance Power Conditioner Model GT100
Supplier:	Advance Electronics
Price:	£100 (approx.)
Date ordered:	(1) November 1984 (2) July 1986

It was considered advisable to fit a voltage stabiliser in the supply line to each of the two cameras so that power supply variation could be eliminated from the list of possible causes of variation in film density.

5. Film processor

Make and model:	Bray 16/35 Microfilm Processor
Supplier:	Bray Film Processors
Price:	£3704
Date ordered:	March 1983

A bench-top microfilm processor requiring connection to cold water and electrical supplies and drain only. (Some widely used microfilm processors require connection to both hot and cold water supplies and the provision of mixing valves.) Of comparatively unsophisticated design lending itself to local servicing. Bray offers a range of processors, of which this is one of the more expensive. It was chosen because it provides a spray wash which should permit complete hypo removal and hence film of archival quality.

6. Densitometer

Make and model:	Macbeth TD929 Densitometer
Supplier:	Macbeth
Price:	US$3200 (approx.)
Date ordered:	March 1983

For density measurements on processed camera film for monitoring the performance of film processor and cameras. This particular model was ordered because it also enables measurements of diazo film density to be made, a feature which it was anticipated would be useful if diazo intermediates were employed for printing (see page 7). In the event, they were not, and a simpler densitometer would have sufficed (e.g.,Macbeth TD262, costing US$1700 approx.).

7. Film inspection box

Make and model:	Keyan Filmcheck Film Illuminator with 10X Loupe
Supplier:	Keyan
Price:	US$339
Date ordered:	March 1983

An illuminated box fitted with film winders. For general film inspection and measurement of resolving power.

8. Microscope

Make and model:	Keyan Shop Measuring Microscope (100X)
Supplier:	Keyan
Price:	US$285
Date ordered:	March 1983

For measurement of resolving power as a means of evaluating camera performance in respect of image quality. Used in conjunction with item 7 above.

9. Film slitter

Make and model:	Motion-Tech Trimmer TRA-16-12.3
Supplier:	Motion Technology Corporation
Price:	US$868
Date ordered:	March 1983

Motion Technology Corporation supplies as standard a trimmer to trim both acetate and polyester film from 16mm to 11mm for use with its proprietary microfilm jacketing system (Comjac®). The slitter obtained for the present project trims film from 16mm to 12.3mm, as required to make 98-frame microfiche masters by the Molex process, and was manufactured to special order. In the event, following the adoption of microfilm jackets in place of Molex masters, the slitter was little used.

10. Hand-held microfilm jacket filler

Make and model:	Microseal 16JR Hand-held Cutter/Inserter
Supplier:	Microseal
Price:	K200 (approx.)
Date ordered:	November 1984

Ordered as a temporary measure in the early months of the project to facilitate jacket loading before funds became available to purchase the normally-used reader-filler.

11. Microfilm jacket reader-filler

Make and model:	Kodak Reader-Filler II (= NB Jackets Reader-Filler II)
Supplier:	Kodak
Price:	A$2700
Date ordered:	December 1985

Selected on the strength of a favourable evaluation by NRCd (ref. 11), and because it could be obtained from a company (in Australia) with which the Audio Visual Unit is in regular contact for photographic supplies.

12. Microfilm jacket reader-filler

Make and model:	Bell & Howell ABR 400 (= NB Jackets Reader-Filler II)
Supplier:	Information Technology Systems
Price:	K1800 (approx.)
Date received:	June 1986

This item of equipment was made available to the Matheson Library on long loan through the courtesy of the University Librarian of the University of Papua New Guinea, being no longer required in the Michael Somare Library there. It was considered that it could be of value in the Matheson Library to provide a back-up for the previous item (11), should this develop trouble, and would in any case provide additional jacketing capacity if needed.

13. Microfiche duplicator (printer only)

Make and model:	Aarque Systems 1050 Microfiche Duplicator
Supplier:	Theodist
Price:	K2340
Date ordered:	October 1982

This duplicator was selected because the author had first-hand experience of using it, because NRCd had favourably evaluated it (ref. 12) and because it could be obtained via a local supplier.

14. Microfiche developer

Make and model:	Aarque Systems 1051 Microfiche Developer
Supplier:	Theodist
Price:	K328
Date ordered:	October 1982

Microfiche developers normally require to be provided with a supply of ammonia, which may come either in anhydrous form from a compressed gas cylinder, or in aqueous form as a concentrated liquid. It was considered by the author that in the situation obtaining in the Matheson Library the use of aqueous ammonia would be safer and present fewer supply problems than the use of anhydrous ammonia.

The developer listed above employs aqueous ammonia and was selected because it is offered as standard with the duplicator listed as item 13 above. The author had no previous experience of using it and it has not, to the author's knowledge, been evaluated by NRCd. In the event, it proved to be disappointingly unreliable, and it was soon necessary to bring into use a developing machine purchased to provide a back-up service (see item 15 below).

15. Microfiche developer

Make and model: Micobra D-11 Diazo Developer
Supplier: Micobra
Price: US$650 (approx.)
Date ordered: March 1986

Ordered to provide a back-up service when the AS1051 developer became unreliable. Selected as one of the least expensive models in the range of an experienced manufacturer. Like the AS1051 Developer, it employed aqueous ammonia.

16. Microfiche duplicator (printer only)

Make and model: 3M 261 Duplifiche Printer
Supplier: Theodist
Price: US$1500 (approx.)
Date ordered: March 1986

Ordered when it became apparent (because of a growing volume of work, and because of difficulty in obtaining spare lamps for the AS1050 Duplicator at a reasonable price) that a back-up microfiche duplicator was desirable. Although the AS1050 had, up to this point, given good service, it was thought that experience of a printer from another manufacturer would be of value. The 3M 261 Printer had been favourably evaluated by NRCd (ref. 13) and could be obtained from a local supplier.

17. Storage cabinet

Make and model: Microstor CF2
Supplier: Microstor
Price: £102
Date ordered: September 1984

Two of these cabinets - specially designed for the storage of microforms - were ordered initially: one for the storage of microfiche masters and the other for the storage of microfiche duplicates.

18. Storage cabinet

Make and model: Microstor CF10
Supplier: Microstor
Price: £359
Date ordered: March 1986

As the project progressed, this further (larger) cabinet was ordered for the storage of microfiche masters. By this time it had been decided that microfiche duplicates would be stored in plastic boxes on open shelving in the library.

19. Visible record system

Make and model:	Okamura 8-drawer Visible Recorder
Supplier:	Steamships
Price:	K300 (approx.)
Date ordered:	July 1985

Acquired to enable a record to be made of each periodical issue filmed. Chosen to be compatible with equipment already in use in the Serials Office, so that the same record cards could be used.

SECTION 4

ACCOMMODATION AND FURNITURE

Early in the project the author drew up proposals for accommodation and staffing for the various activities involved in microfiche production in the form of the table reproduced as Appendix 3.

With a "one-man" microfiche production unit, it will normally make for most efficient working if all the operations involved can be carried out comparatively close to one another, say, in the same or in adjoining rooms.

In the present project, however, practical considerations made it necessary to divide the operations into two groups. This was because, whereas the camera needed to be on the first floor near the Serials Office, where periodicals are received in the library, the film processor needed to be on the ground floor where connections to a cold water supply and drainage were conveniently available. Given the necessary separation of these two activities the operations as a whole were grouped as follows:

Discussion Room No. 2 (first floor)

This room - approximately 20 square metres in area - conveniently located adjacent to the Serials Office, was made available for the project by the University Librarian. Provision was initially made in it for the following (see Appendices 4 and 5):

1. storage of periodicals awaiting filming - until camera operator is ready to film a batch;
2. document preparation - including disbinding and rebinding if required;
3. recording details of issues of periodials filmed;
4. filming;
5. storage of periodicals after filming - until film has passed inspection;
6. quality control of film processing, film inspection, film slitting and stripping up of Molex masters;
7. storage of Molex materials;
8. storage of stripped-up Molex masters.

On the adoption of microfilm jackets in place of Molex masters a jacket reader-filler was installed at 6. On receipt of a second camera - on long loan from the University of Papua New Guinea - this was installed at 2.

Workroom area of Audio Visual Unit (ground floor)

The workroom area of the Audio Visual Unit was designed with provision for two sinks, but only one was in position at the

start of the project. This left a connection for the mains water supply and a drainage connection free for the 16mm microfilm processor. An electric power point was conveniently located nearby. This area of the workroom was therefore cleared of other activities and re-equipped for the following operations (see Appendix 6):

1. Processing of 16mm roll microfilm;
2. Production of diazo duplicates of microfiche masters - Molex masters or microfilm jackets;
3. Storage of camera film and diazo duplicating film (in freezer).

The existence of a sink nearby in the workroom area was important both for the preparation of solutions for the film processor and also in providing access to a supply of water should ammonia used in the microfiche developer accidentally be spilled.

Furniture

In the workroom area of the Audio Visual Unit it was possible to clear an existing bench and use this for the microfiche duplicator (printer and developer units). The bench was long enough to accommodate also a microfiche reader for inspection of processed duplicates and a two-drawer microfiche storage unit.

For the 16mm microfilm processor a sturdy bench (2ft wide x 8ft long x 2ft 4in high, with steel legs to take the weight of the processor when filled with solutions), with plastic laminate top to resist photographic processing solutions, was designed and constructed by the University Central Engineering Workshop.

A number of items of furniture for the Microfilm Room on the first floor were also constructed by the Central Engineering Workshop. These consisted of three tables made to dimensions making the most of the somewhat limited dimensions of the room. One table was used for document preparation, one for the camera and one for film inspection and microfiche stripping up. The tables had white plastic laminate tops, and drawers to hold the various items of equipment and supplies associated with the operations concerned.

Other items of furniture in the Microfilm Room included:

Shelving for serials awaiting filming
Shelving for serials filmed
Table for Kardex-type record unit and two-drawer microfiche storage units
Cupboard for consumables, etc.
Swivel chair for camera operator
Chairs for document preparation, film inspection and microfiche stripping up

Air conditioning

The entire Matheson Library is air conditioned. Areas in the older part of the building have individual air conditioning units which can be regulated locally: the Microfilm Room on the first floor is one of these. The Audio Visual Unit is in the newer part of the building which is air conditioned through ducting from a central unit regulated externally.

During the period of the project the central air-conditioning plant in the Library broke down on a number of occasions. Apart, however, from making working conditions in the Audio Visual Unit extremely uncomfortable at times this did not seriously hinder the project. Fortunately, the failure did not affect the camera operators in the Microfilm Room - or the microfiche masters stored there (see page 38).

(Note: Since leaving Lae the author has learned that it has been agreed within the University that the Library's entire air-conditioning plant should be replaced with new equipment.)

SECTION 5

CONSUMABLES

A surprisingly large variety of consumables are needed in the operation of a microfiche production unit, nearly all of which had to be imported. As a number of these have a limited shelf life, e.g., camera film and, more especially, diazo duplicating film, ensuring that proper stocks were to hand presented special problems, particularly in the early years of the project, when it was not possible to determine production requirements with any accuracy.

In this section of the report details are given of the main consumables required and other consumables are listed briefly. Addresses of suppliers are given in Appendix 2.

1. Camera film

Very early in the project small quantities of four different makes of 16mm microfilm were ordered - three from local suppliers and one from overseas (Australia) - but it was over two years before the project had reached the point where they were required for use. In the meantime they were stored in a freezer. When they came to be used only two of the films (Fuji HRII Film and Kodak AHU Microfilm) were found still to be in excellent condition. The others - though possibly still usable - were in a less than satisfactory condition, showing mottle and high fog.

As the Audio Visual Unit regularly places orders with Kodak it was decided to standardize on Kodak film and to bear in mind that Fuji HRII Film (distributed in Papua New Guinea by Theodist), which performed very similarly to the Kodak film, would be a useful fallback if ever the Unit had supply problems in respect of the Kodak film.

Two main types of film base are used for microfilm: acetate and polyester. (Kodak's brand of polyester base is called Estar.) Acetate is the older of the two types of base but the trend is for manufacturers to switch to polyester. Kodak still supplies microfilm on both types of base but Kodak (Australia) only supplies film on acetate base to special order, and then only with a minimum order of 40 rolls. As this film has to come from the USA, delivery times for Kodak acetate microfilm are much longer than for Kodak Estar (polyester) film.

It is known that some types of film slitter will slit acetate film but not polyester film, and it was suggested at one point that a film cutter built into the Minolta Micro Auto 16 Film Unit might not cut polyester film. Initially therefore, acetate film was ordered for use in the present project while samples of polyester film were tested.

In the event, no trouble was experienced in slitting polyester film with the Motion-Tech Film Slitter obtained for the project, nor was there any problem in cutting the film in Minolta Film Units. Therefore, after initial stocks of Kodak acetate-based AHU Microfilm (Type 7460) had been used up, further production was carried out using Estar-based Kodak AHU Microfilm (Type 1460).The full description of the packing of the latter used was:

> Kodak Imagecapture AHU Microfilm 1460
> (Estar Base), 16mm x 30.5m, Cat. No. 120 5491

The supplier was Kodak (Australasia) Pty. Ltd.

2. Chemicals for film processing

Chemicals marketed by the manufacturer of the film used were employed, as follows:

Developer:	Kodak Microfilm Developer Replenisher, 19 litres, Cat. No. 158 3574
Fixer:	Kodak Microfilm Fixer and Replenisher, 19 litres, Cat. No. 190 1149
Final rinse:	Kodak Photo-Flo 600 Solution, 1 litre

The supplier of all these was Kodak (Australasia) Pty. Ltd.

3. Supplies for the Molex system

The following initial order for supplies for the Molex system was placed on Molex Microfilm Products Inc. in March 1983, at a time when it was still planned to produce 98-frame microfiche using this system:

2500	Molex-fiche No. 101
10	Grid cards, NMA format, No. 501
2	Grid cards, Cosati format, No. 502
5	Carrier sleeves, No. 601
3 doz. prs.	Gloves, film handling, No. 701
5000	Envelopes, microfiche, No.401
1000	Title strips, microfiche, ½" x 5¾", No. 410
1000	Filler strips, ½" x 5¾", No. 440

In the event, as stated earlier in the report, it was decided in November 1984 to use microfilm jackets instead of Molex-fiche for the microfiche masters and consequently few of the above supplies had been used by the time that the author left Lae in September 1986. However, there was always the possibility that some of them might find use if a special job arose in which it was essential to produce microfiche in the 98-frame format.

Two Molex supplies that <u>were</u> put to good use were the microfiche envelopes and the film handling gloves. For the use of the former see under 6 below.

4. Microfiche duplicating film

Three types of film are in general use for microfiche duplicating: silver halide, diazo and vesicular. Silver halide and vesicular films are usually sign-reversing, (i.e., yield positive duplicates from negative masters); diazo film is sign-maintaining (i.e., yields negative duplicates from negative masters). Silver halide film is more expensive than the other two and requires to be handled in a darkroom; diazo and vesicular films may be handled in room lighting.

Diazo film is probably the most widely used type of film in small-scale microfiche duplicating operations, and is more widely available than vesicular film. Diazo film was therefore selected for use in the present project, supplies being ordered from Kodak (Australasia). Kodak initially supplied the following type of film:

> Recordak Diazo M Film 1950 (Estar Base),
> 105mm x 148mm, Cat. No. 161 1037

This was subsequently superseded by the following:

> Kodak Diazo C Film 1957 (Estar Base),
> 105mm x 148mm

Both types of film yielded a so-called "blue" image.

For newspapers offered for sale in microform it was decided to use diazo film with a striped header to improve the legibility of titles, particularly where two or more microfiche are in the same envelope or piled on top of one another. The colour white was chosen for such headers. For this purpose Kodak supplied:

> Kodak Microfiche Type DP22, 105mm x 148mm,
> with 12.5mm White Stripe

This film yielded a so-called "black" image.

5. Ammonia for diazo duplicate film processing

Diazo duplicating film is processed by exposing it to heated ammonia vapour. Depending on their design, diazo processors employ either anhydrous ammonia from a compressed gas cylinder or aqueous ammonia from a bottle of concentrated liquid. As noted earlier, both the processors purchased for the present project were designed for use with aqueous ammonia.

Instructions for the AS1051 Developer specified:

Ammonia 25% or 28° Beaumé at 28°C (s.w. = 0.910)

Instructions for the D-11 Developer specified:

Ammonia 28% - 29.4% (26° Beaumé)

It would appear likely that provided a concentrated solution of ammonia is used (household ammonia is not suitable) the exact concentration is not critical. Concentrated ammonia stocked by the National Analysis Laboratory was found to be very suitable for the purpose. This was obtained by the Laboratory from ICI and was probably what is commonly referred to as "880 ammonia".

6. Microfiche envelopes

The main supplier of microfiche envelopes for the project was Molex Microfilm Products Inc. (see 3 above) The minimum order quantity for these was 5000 envelopes, which Molex normally sends in one parcel by air freight from the USA. This method of despatch, however, proved very expensive and it was found to be cheaper for the envelopes to be packed as two parcels and sent by air parcel post. (When packed as one parcel the envelopes were too heavy for the post.) Molex charged a small fee for the repacking that this entailed.

Other suppliers used for microfiche envelopes in an emergency were:

G.S.Wigg Pty. Ltd.

This company would accept orders for as few as 1000 envelopes, but these were not of the preferred design.

Spicers - Paper Industries Division of James Hardie Paper and Packaging

This company normally required a minimum order of 50,000 envelopes, but on one occasion when the project urgently needed supplies of envelopes at short notice it was in a position to supply only 10,000.

7. Microfilm jackets

The main supplier of microfilm jackets for the project was Kodak (Australasia) Pty. Ltd. They were ordered as:

"5-channel 16mm plain jackets"

and were manufactured by NB Jackets.

On one occasion, jackets were obtained from Theodist in Port Moresby; these were manufactured by 3M.

Five-channel microfilm jackets are made in two very similar sizes which it is important not to confuse. These are the metric size (105mm x 148mm = A6) and the imperial size (4in x 6in = 103mm x 152mm). Not only do the overall sizes of these vary slightly, but so do the widths of the header strips, which are typically 10mm wide for metric jackets and 8mm wide for imperial jackets.

Kodak appears to supply metric jackets as standard, but on the one occasion - when supplies ran short - that jackets were ordered from Theodist, imperial jackets were supplied. These were quite usable but because of their narrower header strip were reserved in the main for periodicals needing only one-line titles. They required extra care when being lined up with 105mm x 148mm diazo film in the duplicating operation.

8. Lamps

Most items of microfilm equipment require special lamps. These include microfilm cameras, readers, jacket reader-fillers, reader-printers and microfiche duplicators.

The Minolta camera used in the project was ordered with spare lamps (short fluorescent tubes), although these appear to be of a standard type. The original lamps were still in use when the author left the project.

One spare lamp was ordered with each of the microfiche duplicators (printers). Further supplies were ordered from the equipment suppliers (Aarque Systems for the AS1050; 3M for the 3M 261), although the prices quoted for them appeared to be excessive. At the time the author left the project less expensive sources of supply were being sought for these lamps (e.g., Philips in the Netherlands for the AS1050 and Bulbman in the USA for the 3M 261).

9. Sundries

Other special supplies required for the project included the following:

Item	*Supplier*
National Bureau of Standards No.1010 Resolution Test Charts: For checking the performance of the microfiche production system in respect of resolution.	Kodak
Process Control Forms Y-55: For monitoring the performance of the film processor.	Kodak

Item	*Supplier*
3M No.850 Tape (Metallic Silver), 19mm wide: For joining exposed film to the leader in the film processor.	Bray Film Processors
Solid Flange Return Reel 16mm x 100ft: For spooling processed film.	Kodak
16mm x 100ft. Microfilm Cartons Cat. No. 402 2059: For storing 16mm microfilm to be left in roll form.	Kodak

SECTION 6

STAFFING

As noted in the introduction to the report, the staffing initially proposed for the project consisted of one Microfilm Adviser and one Technical Assistant for microfiche production. When the author joined the full-time staff of the Matheson Library in October 1983, as Audio Visual Officer, it was envisaged that he would additionally act as Microform Adviser. In the event, however, it was not until April 1984 that he was able to devote time regularly to the project.

Staff selection

The post of Technical Assistant for microfiche production was advertised - both within the University and in the National press - as soon as a pilot production run by the author had shown that the installed equipment was ready for routine work to commence. The post was described as that of "Library Assistant (Microfilm)", and, although it was realised that the duties of the post were of a rather special nature, the qualifications asked for were those required of applicants for a normal post of Library Assistant.

As part of the interviewing procedure, a practical test was given, lasting about half an hour. In this, each applicant was required to examine the image of a specially prepared demonstration microfiche which incorporated a number of production faults: the applicant was asked to identify these. The test proved useful in eliminating a number of weaker candidates from the selection process.

The first Library Assistant (Microfilm) to be appointed took up her post in July 1985 and made a most useful contribution to the start of the project. Unfortunately, she had to resign from the post in December 1985 on leaving Lae with her husband - a final year student in the Department of Agriculture.

A second appointment to the post was made in February 1986, this time in the person of a Library Assistant who had previously been working in the Serials Section of the Michael Somare Library at the University of Papua New Guinea. He continued the good work started by his predecessor and was still in post when the author left the project in September 1986.

Staff training

It is usual in small-scale microfilm operations for all the staff to be familiar with all the production processes involved and to work at each of them in turn. In the present project the best distribution of labour appeared to be for the Library Assistant (Microfilm) to be responsible for all operations except 16mm film processing and quality control - for which staff of the Audio Visual Unit would be responsible. As the work load in the Audio Visual Unit permitted, staff of this Unit also assisted from time to time with the retrospective microfilming of newspapers, with the production of roll microfilm for the University administration and with the production of microfiche duplicates intended for sale.

The small scale of the operation and the small number of staff involved did not, in the author's view, justify the running of formal training sessions in microfilming. Instead, whenever a member of staff came to work at any given operation for the first time, the author demonstrated the operation to the person concerned and remained within call while the learner gained familiarity with the process. None of the operations involved in the production of microfiche by the process employed is especially difficult, but adherence to specified procedures is important. Where appropriate, notices were posted adjacent to various pieces of equipment briefly setting out essential procedures to be followed.

SECTION 7

PRODUCTION PROCEDURES FOLLOWED

Production of 60-frame microfiche using microfilm jackets involves the following operations:

1. filming of the original documents on 16mm roll film;
2. processing of the camera film;
3. inspection of the processed film;
4. titling the microfilm jackets;
5. jacketing the processed film;
6. production of distribution diazo duplicates from the filled microfilm jackets;
7. storage of microfilm jackets under archival conditions.

In this section of the report the procedures used in carrying out these operations are described.

Two important steps preceded microfiche production proper: recording each serial filmed and preparation of the serial for filming.

Two types of record were kept. A record card for each title was kept in a visible record system and each issue noted on the cards upon receipt in the Microfilm Room. A second record was kept in the form of a production sheet for each roll of film (see Appendix 7). On this were written the details (title, etc.) of each issue filmed, in the form in which they were required to appear on the header.

In some microfilming operations, document preparation takes as long as filming. In the present project the work involved was minimal, requiring only occasional removal of staples, the flattening of serials that had been rolled up to go in the post, and, on occasion, the disbinding of reports that would not open fully to enable text extending into the spine to be filmed. (The latter were rebound, after filming, by other library staff.)

1. Filming

For its initial commissioning the Minolta camera was simply placed on a bench of suitable height in the workroom area of the Audio Visual Unit, connected to the power supply and operated as it stood.

When it came to locating the camera permanently in the Microfilm Room on the first floor of the library, a power conditioner (voltage stabiliser) was inserted in the power line to eliminate as far as possible power supply variation as a cause of film density variation. At the same time, care was taken to locate the camera where ambient light would

have a minimal effect on copyboard illumination. With this in mind the clear glass windows in a partition near to the camera were masked with paper to prevent stray light from outside the Microfilm Room from causing uneven illumination on the copyboard.

Although the Minolta camera has an automatic exposure control, it was found, in practice, that the density of film produced with the fluorescent lights on the ceiling of the room switched on was much greater than when the lights were switched off. It was necessary therefore to make a decision as to whether to have the room lights on or off during filming and to ensure that this decision was adhered to in practice. Tests showed that film produced with the room lights off had more uniform density across the frame than film produced with the lights on. It was therefore decided to standardize on working with the lights off.

The copyboard of the Minolta camera is marked with yellow corner marks to indicate the limits of the area covered by the Standard Film Unit at each of the reduction ratios obtainable. When using the Special Film Unit No. 1, which it was originally proposed to use to produce 98-frame Molex masters, the area covered by the camera at each reduction ratio is smaller. It was therefore necessary to determine by practical tests exactly where these limits lay, and to indicate these with additional corner marks. In the event, with the change to the 60-frame jacket format, these additional corner marks were not normally needed.

It is a widespread practice, when producing microfiche, to include "targets" (legend charts) before and after the document filmed, giving a variety of types of information for the benefit of the user. Such charts may also be designed to be of assistance to the producer of the microfiche in controlling their technical quality. In the present project it was decided to produce a set of such targets, scaled for each reduction ratio in the range available, which would yield micro-images of a constant size and so contribute to the good appearance and uniformity of the finished microfiche. Procedures for making such "constant-image-size legend charts" have been described in the literature (ref. 14).

It was decided that the following information should be given on the targets:

1. *Target preceding document (see Appendix 8):*

   a. name of the organisation producing the microfiche i.e., The Papua New Guinea University of Technology;
   b. National Bureau of Standards (NBS) Microcopy Resolution Test Chart;
   c. reduction ratio used.

2. *Target following document (see Appendix 9):*

   a. name of the organisation producing the microfiche;
   b. clear area for density measurement;
   c. the word "END".

3. *Target at end of microfiche continued on a further microfiche (see Appendix 10):*

   a. name of the organisation producing the microfiche;
   b. clear area for density measurement;
   c. the word "CONTINUED".

Four sets of targets were made, one for each of the four reduction ratios provided for on the Minolta Micro Auto 16 Camera, i.e., 21X, 25X, 27X and 29X. In the event it was not considered practicable to use the "CONTINUED" targets.

Lettering for the artwork for the targets was prepared using a 3M (Kroy) lettering machine for the name of the University and a Leteron machine for the larger characters. The targets were made photographically on glossy, medium-weight paper which was mounted on thick strawboard. Resolution test charts were dry-mounted on targets preceding documents and all targets were protected with clear heat-seal film.

It was found that a reduction ratio of 21X was suitable for all documents up to A4 in size. Foolscap (8in x 13in) documents required the use of a reduction ratio of 25X. Papua New Guinea newspapers, all approximately A3 in size, could with care be accommodated at a reduction ratio of 27X, but to ensure that nothing was lost at the edges using this reduction ratio required very great care in positioning the newspaper on the camera copyboard and thus slowed down the filming operation. A reduction ratio of 29X was therefore adopted as standard for newspapers. In practice, apart from newspapers, a reduction ratio of 21X was used almost continuously in the project.

The camera was operated following the manufacturer's instructions within the framework of the locally-developed procedures listed in Appendix 11, a copy of which was fixed to the wall near the camera.

A leader of 200 frames (instead of 100 frames as recommended by the camera manufacturer) was run off before starting filming for reasons associated with the particular film processor employed. (With the Bray 16/35 Microfilm Processor the first 2 metres of a roll of film is liable to be overdeveloped as it stands idle at the end of processing while the leader which follows is attached.)

A "grey scale" was produced at the start of each roll of film by making an exposure, with a white sheet of paper on the camera copyboard, with the shutter speed control set in

turn to each of its 12 settings. This provided a means of checking the performance of the film processor and camera in subsequent quality control procedures (see Section 8).

Initially, in the project, 11 blank frames were left between each document to ensure that when film came to be cut up into 12-frame lengths for jacketing by hand a row with only one frame would still be of the full length. With a jacket reader-filler in use this spacing could, without loss, be reduced to a single frame - or even eliminated altogether, if preferred.

One of the most important settings that the operator has to make when using the camera is the exposure setting. This is a key to the quality of negatives obtained. The setting to be chosen in any situation will be influenced by the degree of development provided by the film processor. Because of the importance of this topic a separate section of the report is given to it, under the heading "Quality Control" (see Section 8).

One aspect of filming that surprisingly receives no mention in the camera handbook is the required orientation of documents on the copyboard during filming. While this can fairly readily be worked out it may perhaps be helpful to note that normally the top of a document should be at the left of the copyboard.

2. Film processing

As already noted in Section 4 of the report, provision already existed in the workroom area of the Audio Visual Unit for cold water supply and drains connections. As received, the processor was completely devoid of any indication of the contents of the various tanks and the processing speed control was uncalibrated. Suitable labels were therefore made and affixed to the processor to show the contents of the various tanks, as indicated in the instructions accompanying the processor, as follows:

Tank 1	Developer
Tank 2	Running rinse
Tank 3	Fixer
Tank 4	Running rinse
Tank 5	Spray wash
Tank 6	Final rinse

The divisions on the uncalibrated FILM SPEED scale were numbered 0, 5, 10, 15, 20, 25 and 30 respectively.

As a first step in commissioning the processor, the processing tanks were rinsed with water, checked for leaks, and then filled with the appropriate solutions up to the capacities indicated in the machine instructions. While

special microfilm chemicals were awaited, initial testing of the machine and pilot production work was carried out using Kodak D-19 developer (a general-purpose film developer of high activity, of which a stock was held in the Audio Visual Unit) and a general-purpose film fixing bath.

It seemed desirable to know the linear film speed provided by the processor at various FILM SPEED settings and this was therefore timed, with the following results:

Film speed setting	*Linear film speed (metres/minute)*
5	0.52
10	1.56
15	2.60
20	3.90
25	5.20
30	6.50

Examination of the literature suggested the use of 30°C as an appropriate development temperature and tests were therefore made - with the solutions brought to this temperature - at FILM SPEED settings of 10, 15 and 20 respectively. After examination of the processed films it was concluded that within this range of settings processing speed was not critical (provided it was constant) and that a setting of 15 provided a useful basis for initial work with D-19 developer. This would need to be confirmed when the proper chemicals arrived.

Measurements had shown the length of the film path in the developer tank to be approximately 2 metres. A FILM SPEED setting of 15, giving a linear film speed of 2.6 metres per minute, therefore corresponded to a development time of approximately 46 seconds.

In the event, a FILM SPEED setting of 15 proved suitable also for use with Kodak Microfilm Developer and Replenisher when this finally arrived (the first delivery went missing *en route*). Later in the project, however, it was decided to increase the FILM SPEED setting to 20, for reasons discussed in Section 8 - Quality Control.

During the period that the author was associated with the project the number of films requiring processing rarely exceeded two a week. Exhaustion of solutions, therefore, arose largely from aerial oxidation rather than from use. Tests showed that the activity of the developer was usually little changed until after standing for three weeks or more, but to be on the safe side the practice was adopted of changing the solutions every two weeks. (This provided a margin of safety for occasions when the air conditioning in the workroom area was out of action.) It seemed reasonable to change the fixer after only every four weeks. When

operating in this way it was unnecessary to replenish either solution.

The processor was operated following closely to the manufacturer's instructions. A sheet summarising these was prepared and fixed to the wall near the processor, together with a sheet listing the procedures to be followed when renewing solutions (see Appendices 12 and 13).

As received, both the developer and fixer thermometers read incorrectly. It was also noted that when controlled by the built-in thermostats the solutions appeared to range widely in temperature about the values selected. It was therefore decided to control the developer temperature manually by inserting a dial thermometer in the top of the developer tank, and to switch the heater on and off - using the thermostat control as a switch - as required. When operating in this way it was necessary to remember to remove the thermometer from the developer tank before closing the lid at the start of processing.

The temperature of the fixer - which was not as critical as that of the developer - was controlled by ensuring that its heater was switched on for the same time time as the developer heater.

Some time after the processor had been installed instructions were received from the manufacturer as to how to adjust the readings of the two built-in thermometers, but as the method of working described above had proved satisfactory it was decided not to change it.

It was found that a Tel-Tru thermometer purchased especially for use with the microfilm processor yielded readings 2°C higher than those given by a more expensive Vivitar thermometer which had given satisfactory service for a number of years for colour film processing (Process E-6) in the Audio Visual Unit. It was assumed that of the two thermometers the Vivitar was more likely to be correct and the processor was therefore operated with the Tel-Tru thermometer reading 32°C (for a true temperature of 30°C).

The processor was received with only one leader, 50ft 4in (15.34m) long. To process short lengths of film (i.e., shorter than the leader) two leaders are needed. Additional leaders were therefore made by processing (without exposure) an out-of-date roll of polyester-based microfilm and cutting this in half.

For splicing the end of unexposed film to the leader 3M No.850 (Metallic Silver) Tape, 19mm wide, supplied by the manufacturer of the processor, was used. Experience showed that no attempt should be made to effect a splice on the leader while wet; nor should any attempt be made to use tape

a second time in the interest of economy. Both practices could lead to the splice coming apart during processing, with dire results.

White plastic spools were obtained from Kodak to serve as take-up spools (although the black spools on which film was supplied could have been used for this purpose).

A record was kept near to the processor showing the dates when solutions had been made up, so that their condition could be known at any time. This record also served as a reminder as to when they needed replacing. The number of films processed and the dates of processing were also recorded (see Appendix 14).

After a film had been processed the leader was cut off and discarded and the grey scale cut off for density measurement. (See Section 8 - Quality Control.) The remainder of the processed film was then returned to the camera operator for inspection (see below).

3. Film inspection

The nature and degree of inspection required in a microfilming operation will vary, depending on the nature of the records being filmed and the use to which the resulting microfilm is to be put. Where the application includes micropublishing, i.e., making copies available for sale, as in the present project, it is normal to inspect every frame in some measure. This is referred to as 100% inspection. To achieve this in the present project, the exposed and processed film was examined over a special light box provided with winders to permit the film to be advanced along its length as required. While handling the film for this operation - as for the operations involved in quality control, jacketing and duplicating - the operators concerned wore white nylon gloves.

The procedure adopted in film inspection was first of all for a general examination of the film to be made with the unaided eye, looking for overall fog, edge fog, scratches and obstruction of the film by hands, etc. Then the film was examined frame by frame using a 10X loupe (magnifying glass). The general procedure followed in the frame-by-frame inspection was to examine the page number of each frame to see that it was sharp and that no pages were missing. Some of the faults encountered in this inspection and the remedies adopted are listed on the next page:

Fault	*Remedy*
Fog on leader or trailer extends into document area	Refilm complete document (or part of document) affected.
Edge fog	If this extends into image area, or is serious enough to spoil appearance of microfiche, refilm pages affected.
Single page unsharp	Check that original document is sharp. If it is, note frame affected, proceed to jacket film and refilm complete row containing unsharp page.
Page obscured by hand(s)	Proceed as above, i.e., Refilm complete row containing obscured page.
Fine white scratches not affecting image	Clean camera rollers and gate, and squeegee in final rinse, and watch situation.
Black scratches (stress marks) affecting image	Clean camera rollers and gate; refilm complete roll. (See also Section 10 - Problems Encountered.)

Unless urgently required by readers, documents filmed were kept in the Microfilm Room until jacketing was completed, so that if any query arose during inspection they were available for refilming if required.

4. Titling the microfilm jackets

Early in the project, consideration was given both to the wording and to the production (typing) of headers for the microfiche. International Standard ISO 5123 (ref. 15) lays down rules for the presentation of the information to be provided and was followed in general terms. Titles of serials were given in the form used in the Second Edition of the National Union List of Serials (NULOS 2).

In an endeavour to obtain as legible titles as possible it was decided to produce these on an IBM Executive Typewriter with film ribbon. Tests were made with all the different typefaces ("golf balls") available in the Library office and diazo duplicates were made from these. After examining the results of the tests it was decided to standardize on the Letter Gothic typeface.

At a later stage in the project, when the IBM typewriter was out of action for a period of some weeks awaiting servicing, it was necessary to find an alternative means of producing headers. An Olympia ES100 Electronic Typewriter was

available in the Library office, and it was found that this machine fitted with a Classic Gothic "daisy wheel" (Whisperdisc 808/10-12/654) gave a result very similar in appearance to the IBM typewriter.

When routine production began, as soon as a production sheet giving titles of serials filmed was completed a copy of the sheet was made and passed to a keyboard operator in the Library office for the typing of the necessary jackets. It was the camera operator's responsibility to indicate on the production sheet where more than one jacket was required. For example, if a document occupied more than 60 frames and required two jackets, the camera operator would mark in the margin against the title concerned: 1/2, 2/2. In the absence of any such mark it would be assumed that only one jacket was required.

5. Jacketing

As noted earlier, when the project began it was proposed to produce microfiche masters using the Molex system which requires no special equipment for stripping up - only a printed grid and a pair of scissors.

The filling of microfilm jackets, however, normally requires the use of a jacket reader-filler costing approximately K2000. As funds were not available to purchase this initially, it was decided to start filling jackets by using an inexpensive hand-held cutter-inserter. While delivery of this was awaited it was found possible to fill jackets by hand without the use of any equipment other than a pair of scissors - albeit at a slow pace. The operator wore nylon gloves for this operation and needed to exercise care that the strips of film were accurately lined up to give a neat appearance to the finished microfiche.

It was not until the third year of the project that funds became available for the purchase of a proper jacket reader-filler. On receipt, this was soon brought into use and proved invaluable in speeding up the jacketing operation at a time when production was increasing.

6. Microfiche duplication

The microfiche duplicator selected for the project was of the type which consists of two separate units - a printer and a developer. The duplicator was the first item of equipment to be installed and commissioned and was one of the easiest to install - requiring only a power connection.

The printer was essentially a light box employing a high pressure mercury vapour lamp as light source. It required to be switched on about 10 minutes before use to allow the lamp to reach its full intensity, and once it had been switched

off it required to be allowed to cool down for a few minutes before it could be switched on again.

The function of the developer unit was to bring the exposed diazo duplicating film into an atmosphere of heated ammonia vapour. Like the printer, the developer required to be switched on about 10 minutes before use, in this case to allow the heaters to come up to temperature. The machine required a supply of aqueous ammonia (see page 14): commercial concentrated ammonia of the type commonly referred to as "880 ammonia" was used. Great care needed to be taken when handling this; in particular, not to innale its vapour when filling the ammonia bottle on the developing machine.

Tests were made to determine suitable exposure times for the printer and as the project progressed it was found that, provided the densities of the film in the microfilm jackets fell within the levels aimed at, a constant exposure time could be used in the printer. This time would, however, need to be gradually increased as the lamp in the printer aged. It would also need to be changed if the type of diazo film used was changed.

In normal production, microfiche quality was judged by a cursory examination of each duplicate as it emerged from the developer, but a microfiche reader was installed alongside the duplicator to enable more critical examination of the microfiche to be made from time to time. Exposure was judged to be correct when a duplicate had a good density overall but small type was not "clogged".

Besides checking on the density of the processed microfiche the operator would look at their "colour" to ensure that they were properly developed. Any duplicate that looked incompletely developed would be put through the machine a second time. Incomplete development could arise from a lack of sufficient ammonia in the machine or because the machine was not fully warmed up.

Diazo duplicating film has a useful life of only a few months if stored at normal room temperature, even if in an air-conditioned building. The first sign that the film is "going off" is that the background is stained, instead of being completely clear. If stored in a freezer, however, diazo film will keep for two or three years. Care was therefore taken in the present project to store all diazo film in a freezer when not in use. A pack of 500 sheets of diazo film needs to be removed from a freezer at least 12 hours before it is to be used, to allow it to warm up to room temperature and to allow any moisture that condenses on the wrapper to evaporate. It was, therefore, necessary to plan ahead and remove from the freezer the previous day sufficient film for the following day's work.

As noted earlier (page 7), in micropublishing operations in which large numbers of duplicates are required, it is common practice to produce diazo "intermediates" from the microfiche masters to serve as printing masters, and thus minimise the wear and tear on the originals. Special diazo films are available for the production of such printing intermediates. Inclusion of this additional printing step calls for rigorous quality control of the whole operation and in the present project it was not considered that the number of copies likely to be required made it necessary.

7. Microfiche distribution and storage of masters

The finished duplicates were inserted in microfiche envelopes before being passed to the Serials section of the Library. Where a periodical occupied more than one microfiche all the microfiche concerned were placed in a single envelope separated by white paper separators (A4 copying paper quartered to A6) to assist in the reading of the titles.

Microfiche of newspapers to be sold in sets were duplicated onto diazo films with striped headers to give a more professional appearance; this made paper separators unnecessary. These microfiche in their envelopes were assembled in sets (e.g., for weeklies, the microfiche for a complete year's issues), together with a card indicating the contents of the set, and banded with strong rubber bands.

On completion of duplication, the master jackets were stored in special cabinets designed for the storage of microforms. At the start of the project the masters were located alongside the duplicator on the ground floor, with the idea that this would enable orders to be met without the need for the operator to go elsewhere for the masters.

As the project progressed, however, it was found that it was more important for the masters to be located in the Microfilm Room on the first floor, so that they could be referred to at any time that a query arose as to whether a particular issue had been filmed. In principle, the "Kardex" type records should have provided this information, but in many cases it was found that only by referring to the microfiche masters themselves could certainty be arrived at. The masters were therefore moved from the Audio Visual Unit to the first floor. This did not appear to hinder the production of duplicates in any serious way.

If these masters are to have a long life, their storage conditions will require more consideration than has been given to date. Recommended humidity and temperature ranges for long-term or archival storage of silver halide film on polyester base are (see ref. 16):

Relative humidity (range):	30-40%
Temperature (maximum):	70°F

It is doubtful if these conditions are currently being met on a 24-hour basis, seven days a week. (But see Note on page 19.)

SECTION 8

QUALITY CONTROL

If a microfiche is to serve its purpose as a substitute for a printed serial it must be clearly legible. To achieve this attention must be given to the density and the resolution of the master and duplicate microfiche. In practice, it is the quality of the master which needs most attention; if the master is clearly legible it is not difficult to obtain good duplicates.

By "density" of a microfiche master is meant the background density of the camera negative (corresponding to the white areas of the original document), as measured on an instrument called a "densitometer". This gives a numerical indication of the "blackness" of the film - the blacker the negative, the higher the density. Completely clear microfilm has a density of 0.0; completely black microfilm a density of a little over 2.0. Recommended density values for microfilming are given in various standards. For example, British Standard BS 5976:1980 (ref. 17) recommends use of background densities ranging from 0.90 to 1.50, depending on the quality of the original document; the better the quality of the original, the higher the density to aim for.

In the present project, the serials to be filmed ranged in quality from high quality printed documents to poor quality photocopies. With such a mixture it was necessary to choose a background density to suit the poorest quality originals, since quality is most critical with these. For the present project, therefore, it was decided to aim at a background density of 1.0, i.e. near the lower end of the recommended range. It is necessary to allow for some variation about any value chosen to cater for variation in film quality, processor performance etc, and it was considered that a realistic goal would be a background density in the range 0.8 to 1.2, usually expressed as 1.0 ± 0.2.

For a given type of film, the background density obtained is determined by two main factors: (1) the exposure that the film receives and (2) the processing (in particular, the development) that the film receives. It is necessary in microfilming operations to bring the processing under control first and then to adjust the exposure setting on the camera to obtain the required background density on production work.

Microfilm processing is normally controlled by noting any variation in the densities obtained on processing pre-exposed "quality control" strips, supplied by the film manufacturer. With the daylight-operated machine employed in the present project it was difficult to use such strips. Instead, a "grey scale" (a series of exposures to a sheet of

white paper at different settings of the camera exposure control) was exposed at the start of each production roll and used as a "quality control" strip. This procedure was justified only so long as the performance of the camera remained constant. This was an additional argument for fitting a power conditioner (voltage stabilizer) in the camera power line.

After each film had been processed the grey scale was cut off and the densities of each of the 12 steps measured and recorded on a locally-designed form (see Appendix 15). The density of the clear film adjoining the grey scale was also measured and entered on the form against "Base+fog".

The density produced at the camera speed setting being used in practice, and the base+fog density, were then entered on a Kodak Process Record Form No.Y-55 (see Appendix 16). This provided a picture of what was happening and enabled corrective action to be taken as necessary. As noted earlier in this section, the objective was to achieve a working background density in the range 0.8 to 1.2. For the "base+fog" density a value not above 0.1 was aimed at.

Once processing conditions had been standardized (see page 31), the camera exposure setting which gave a density of 1.0 (or a little over, to allow for a slight drop in density over the life of the processing solutions) was chosen and used for all production work.

Film processed immediately after exposure yields higher densities than film processed a few hours (or days) after exposure. (This is because of a phenomenon known as "latent-image regression".) When tests were made to determine the best exposure setting to use in the project, it was common practice to process the film within half an hour of exposure. In the normal course of production, however, it was usually several hours after the last frames on the roll were exposed (and possibly several days since the first frames were exposed) before the film was processed. To allow for this, when tests were made which were to be processed immediately, a density of 1.2 (rather than 1.0) was aimed at. It was found that this would lead to a background density of approximately 1.0 on production negatives.

At the beginning of this section, "resolution" was listed as the second of two important factors to which special attention must be given if clearly legible microfiche are to be produced. By "resolution" of a microfilming system is meant the ability of the system to reproduce fine detail. This is expressed numerically as "resolving power", defined as the number of pairs of black and white lines per millimetre that can be distinguished as individual lines when the image of a test pattern is examined with a microscope.

The United States National Bureau of Standards (NBS) has developed (and made available on sale) special Microcopy Resolution Test Charts to enable resolving power readings to be made in a consistent manner.

As already noted (page 29), an NBS resolution test chart was incorporated in the target filmed at the beginning of each serial. In routine production, the image of the first target on each roll of film was examined, using a 100X microscope, with the film on a special inspection light box. The number against the smallest set of lines judged to be resolved ("the smallest pattern in which the bars can be counted with reasonable assurance") was read and recorded on the same form used to record film densities (see Appendix 15).

A typical microcopy resolution reading when filming at a reduction ratio of 21X was 8.0; this applied to the centre of the field. Tests made when commissioning the camera showed that in the corners of the field a result one or two targets coarser on the scale (i.e., 7.1 or 6.3) could be assumed. The British Standard Specification for 60-frame microfiche (see ref. 8) states that the minimum microcopy resolution test chart pattern to be resolved in first generation film is 6.3 when working at a reduction ratio of 20X, or 5.6 when working at a reduction ratio of 22X. The results achieved in the project met this requirement.

Not only did the resolution test provide assurance that adequate resolution was being achieved, but any appreciable variation from the normal value served to give early warning of potential trouble in the system.

SECTION 9

WORK COMPLETED

By the time the author left the project in September 1986 the following serials had been filmed:

a. *Current filming*

All Papua New Guinea serials received in the Matheson Library from August 1985 to September 1986 (over 300 titles)

b. *Retrospective filming*

"The Times of Papua New Guinea", 1983 - September 1986
"Wantok", 1983 - September 1986
"Papua New Guinea Post-Courier, 1981 - September 1986
"New Nation", 1983 - September 1986
"Niugini Nius", 1985 - September 1986

"The Times of Papua New Guinea", "Wantok", "Papua New Guinea Post-Courier" and "New Nation" were all at one time reproduced on 35mm roll microfilm by the University of Queensland, but this operation appears now to have stopped. The years chosen for the commencement of microfilming these titles were the years following the latest issue of the title concerned held on roll microfilm in the Matheson Library.

During the project it was learned that "Niugini Nius" for the years 1972-1984 had been filmed on microfiche by a group of libraries in Port Moresby. Retrospective filming of this title was therefore started with the issues for the year following this operation, i.e., 1985.

"The Times of Papua New Guinea" for the years 1983, 1984 and 1985 was offered for sale on microfiche by the Matheson Library in February 1986. The prices were: 1983(69 issues) K70; 1984(52 issues) K50; 1985(52 issues) K50. By September 1986 plans were in hand, or contemplated, to offer for sale all the other titles listed above.

Since 1983 the Matheson Library has been identifying - and obtaining copies through Inter-Library Lending channels - articles about Papua New Guinea published in journals to which the Library does not subscribe. In July 1986 the microfilm unit began filming these - one article to a microfiche - for permanent retention in the Papua New Guinea Reference Collection. By September 1986 copies of over 200 articles had been preserved in this way and it was planned to produce a title index to this new information resource.

In addition to its primary task of microfilming serials in the Library, the microfilm unit undertook, in 1986, microfilming work for the University administration. This involved the filming - on 16mm roll microfilm - of the agenda and minutes of the University Council and Academic Board from the commencement of the institution in 1967. The filming was requested following a general review by the administration of its records management practices.

SECTION 10

PROBLEMS ENCOUNTERED

1. General

The setting up of a microfiche production unit in the Matheson Library meant introducing new technology to the Lae area. A number of organisations are engaged in microform production in the Port Moresby area but in Lae the University was pioneering. (Microfiche masters are being produced on a small scale at the Ampo headquarters of the Evangelical Lutheran Church of Papua New Guinea, but this organisation has no processing or duplicating facilities.)

This meant that the author had to work very much on his own in locating sources of equipment and consumables in the region. Efforts were made to obtain a directory of microfilm suppliers in Australia, but without success. Fortunately, the Matheson Library held a complete set of Australian telephone directories, and the Yellow Pages in these were of help in tracking down suppliers. The ordering of equipment and materials and the progress chasing of orders probably accounted for at least half of the time that the author spent on the project.

Goods ordered took a long time to arrive. For a variety of reasons, it was usually about 10 days before an order originated by the author even left the University. Orders for which air freight was specified took from 1 to 2 months to arrive; orders by sea took from 3 to 4 months. As the project progressed use of air freight increasingly appeared to be justified - despite the increased cost - but for some products, e.g., processing chemicals in liquid form, air freight was not permitted. (The times quoted applied to orders from Australia; orders from Europe and the United States of America took longer.)

The number of orders lost or damaged was fortunately very small, but loss of even one order could delay the project for several months.

The project really required for its first one or two years the full-time services of a consultant, and, as explained in the introduction to this report, efforts were, in fact, made to obtain such help. It was only when these failed that the author was asked to head the project on a part-time basis in addition to his work as Audio Visual Officer. The result was that both jobs suffered and the microfilm project progressed more slowly than was desirable.

2. Equipment

The following faults were encountered in the period up to September 1986:

Bray 16/35 Microfilm Processor

Fixer circulation pump inoperative on arrival. Found to be obstructed by silica gel bag.

Developer and fixer thermometers read incorrectly on arrival. See page 33.

After a period in use fixer heater failed to operate. Fuse and diode(?) in heater circuit replaced by University Electronic Services Unit (ESU).

Diazo duplicators

AS1051 Developer failed to feed film correctly from time to time, as a result of which the occasional film became trapped in the machine which had to be dismantled to remove it. The fault became increasingly frequent and a back-up machine had to be brought into use in its place.

AS1051 Developer heater failed as a result of internal wire being severed by a rat(?). Repaired by ESU.

AS1050 Duplicator (printer) shutter failed to operate as a result of its bearing against body of machine. Repaired by ESU.

AS1050 Duplicator high-pressure mercury vapour lamps failed after only a few hours' use. (Rated life is 500 hours.) As these lamps are very expensive (approx. K200 each) a failed lamp was returned to the manufacturer (Philips) for comment. No reply had been received by the time the author left the project. (It has occurred to the author that the lamps might have failed because of a surge in the supply voltage.)

A 3M 261 Duplifiche Printer ordered as back-up for the AS1050 Printer was inoperative on arrival; the pressure pad failed to operate a microswitch on closure. The fault was rectified by the ESU.

3. Film scratching

About one in ten of the rolls of film exposed in the Minolta (and Bell & Howell) film units showed black stress marks throughout their length. The position or these marks across the width of the film corresponded to the rubber "lands" on 6mm diameter rollers bearing on the film in the film feed and take-up chambers. Some of the stress marks showed a pattern repeated at 19.3mm intervals - the circumference of the small rollers. Other stress marks were repeated at 11.75mm intervals — equal to the film frame advance.

That the fault was associated (at least in part) with the rubber "lands" on the small rollers was confirmed by examination of the roller in the film feed chamber, which from time to time developed a "flat".

The fault was cured by smoothing out the flat where this had been formed, reversing the small roller in the feed chamber end-for-end or interchanging the two rollers. At the same time, compressed air from a small aerosol can was used to clean the camera gate. When, after a time, there appeared to be a risk of the rubber "lands " on the two small rollers disintegrating, replacement rollers were ordered. The fault affected all the film units employed and is known to have been encountered by the Summer Institute of Linguistics at Ukarumpa, where a similar camera is in use.

Various tests were made in an endeavour to determine exactly the cause of the fault. In one of these, a film unit which had just produced severe stress marks on a production film was used unchanged for the following (test) film. No stress marks were obtained: the fault had cured itself!

Samples of film showing the fault were sent to the Minolta microfilm camera agents in Australia, but they could shed little light on the problem beyond mentioning that when, on one occasion, the problem had arisen elsewhere, the film itself had been found to be at fault. This seemed unlikely to be the cause in the present instance, since several batches of film were concerned, some on acetate and others on polyester base, and, in any case, nine out of ten films showed no fault. The problem was still unresolved when the author left the project.

4. Exposure control

As noted in the section of the report on Quality Control, one of the two most important factors in obtaining good quality microfilm is the density of the film. It proved difficult with the Minolta Micro Auto 16 Camera to control the density of the film as closely as was desired. The increments between the densities obtained at different settings of the shutter speed control were larger than seemed necessary, and the settings giving densities in the region of 1.0 (the aim point) were all bunched at one end of the scale. Typical densities obtained on Kodak Image Capture AHU Microfilm were:

Shutter speed	*Density with Micro Auto 16*	*Shutter speed*	*Density with Micro Auto 16*
1	2.14	7	1.70
2	2.12	8	1.53
3	2.08	9	1.40
4	1.99	10	1.24
5	1.92	11	0.91
6	1.82	12	0.58

As will be noted from these figures, the density increment between one shutter speed setting and the next, for a desired density of 1.0, is in the region of 0,3, which is high in relation to the limit aimed at of ± 0.2.

Examination of the circuit diagram of the camera suggested that alteration of the shutter speeds might be possible by adjusting two rheostats on a printed circuit board in the camera. The Japanese manufacturers of the camera were asked whether any such adjustment was possible, but a reply through their Australian agents stated that a new printed circuit board (costing about K200) should be fitted. This was ordered but was lost in the post, and a replacement had not arrived by September 1986.

When a second camera (Bell & Howell Filemaster II = Minolta Micro Auto Dual 16) was received, in mid-1986, on long loan from the University of Papua New Guinea, it was noted that the densities yielded by this were very different from those given by the first camera, on the same film stock, as the following table shows:

Shutter speed	*Density with Micro Auto 16*	*Density with Filemaster II (Micro Auto Dual 16)*
1	2.1	1.73
2	2.12	1.68
3	2.08	1.62
4	1.99	1.55
5	1.92	1.47
6	1.82	1.38
7	1.70	1.28
8	1.53	1.17
9	1.40	1.05
10	1.24	0.92
11	0.91	0.79
12	0.58	0.66

With the second camera the density increment for shutter speeds yielding a density of 1.0 was about 0.13, i.e., less than half that yielded by the first camera.

5. Exposure of newspapers

The control of the background density of serials consisting solely of text caused no special problems. Newspapers, with their illustrations, however, presented the automatic exposure sensor in the camera with a darker-than-usual image which the exposure measuring circuit in the camera interpreted as necessitating a longer-than-usual exposure.

This led to the production of an excessive background density on the images of pages containing illustrations: in exceptional cases a density as high as 2.0 was produced. The

text in duplicates of such images tended to be "clogged", and was readable only with difficulty.

The extent of this problem was not recognised until towards the end of the author's time with the project: it warrants futher investigation. Possibly, in the case of newspapers, a lower density should be aimed at, say, 0.8 or 0.9 instead of 1.0, although care would need to be exercised to ensure that use of a different exposure setting for newspapers did not cause confusion.

6. Filming thick publications

Most microfilm equipment is designed with business applications in mind, rather than library applications. The Minolta Micro Auto 16 is no exception to this rule, being designed primarily for copying business records, which are very largely single sheets of paper. The camera may, however, be used successfully for other than business records provided its limitations are recognised. Thus, it is quite suitable for the filming of serials, provided that these are not too thick and will lay flat.

The manufacturers state that the Micro Auto 16 has a depth of field of 20mm, the plane of sharpest focus being located 10mm above the surface of the copyboard. Some tests made by the author while working at Ukarumpa suggest that 20mm is a conservative figure.

The filming of thick publications that will not lay flat unaided presents special problems. With thinner publications that will not otherwise lay flat it is possible to place a sheet of plate glass over the opened publication and to film through this, lifting the glass as required to turn the pages. With thick reports, which, in the present project were sometimes as long as 500 pages or more, this procedure would have been very time-consuming and was not considered justified. During the period of production filming in the project (August 1985 - September 1986) some 20 publications coming in this category were therefore left unfilmed.

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APPENDIX 1

TIMETABLE OF THE PROJECT

1982

May Author joined staff of Matheson Library part-time as Audio Visual Officer (temporary), on release from the Summer Institute of Linguistics (SIL).

August Initial planning of project by University Librarian.

September Submission of request for funding for equipment.

October Author resigned from part-time post in Matheson Library to resume work full-time at SIL.

1983

October Author joined staff of Library full-time as Audio Visual Officer.

Microfiche duplicator installed and commissioned.

1984

January Microfiche duplicator used to produce duplicates of Molex-fiche for SIL.

April Author started to work continuously on project (half-time).

16mm microfilm processor installed in workroom area of Audio Visual Unit, and commissioned using "temporary" chemicals. Tests made to determine suitable temperature and film speed settings.

Minolta Micro Auto 16 camera installed temporarily in workroom area of Audio Visual Unit. Corner marks for Special Film Unit No. 1 located and marked on copyboard.

May Densitometer received and commissioned.

Tests made of different type faces for use as headers and preferred typeface chosen.

14 periodical issues filmed and Molex masters and duplicates made as a pilot project to provide experience in all the operations involved in microfiche production in the local situation.

Procedures for the routing and recording of periodicals to be filmed worked out in discussion between the University Librarian, Serials Librarian, Papua New Guinea Collection Librarian and the author.

Accommodation and furniture for Microfilm Room in former Discussion Room No. 2 planned.

September Furniture for Microfilm Room ordered from Central Engineering Workshop.

1984 (continued)

October Furniture received and installed in Microfilm Room.

Major change in microfiche format and production method proposed by author (use of 60-frame microfilm jackets instead of 98-frame Molex-fiche).

Camera "targets" incorporating University logotype designed; production put in hand in Audio Visual Unit.

Proper chemicals for 16mm microfilm processor received.

November Instructions for use of proper microfilm chemicals received.

Camera "targets" completed.

Proposed change in microfiche format and production method agreed to by University Librarian. Film Unit for the purpose ordered.

1985

March Minolta Micro Auto 16 Camera installed in its permanent location in Microfilm Room on first floor of Library and recommissioned.

Various film stocks tested. Quality control system devised to suit local situation.

Policy for wording of headers agreed in discussion with Serials Librarian and Papua New Guinea Collection Librarian.

Production microfilming of Papua New Guinea serials started by the author. Special Film Unit No. 1 used for the first four weeks, until the Standard Film Unit (required to produce 60-frame microfiche conforming to international standards) arrived. Filming continued for eight weeks, by which time pressure of other work in the Audio Visual Unit made it necessary for the project to be halted until a Library Assistant (Microfilm) was in post.

April At the request of the University Librarian consideration was given to the feasibility of reassembling, at the end of each year, the strips of film comprising the microfiche produced that year, in such a way as to reduce the number of microfiche. (Many serials occupied only one or two channels of the five-channel microfilm jackets.) This was decided against as probably not yielding as great a saving as might be expected and as being very difficult to carry out and administer.

1985 (continued)

July	First occupant of the post of Library Assistant (Microfilm) commenced work (Mrs Fiona Kamouda).
August	Filming of current serials resumed.
September	Retrospective filming of newspapers started ("The Times of Papua New Guinea").
December	First occupant of the post of Library Assistant (Microfilm) resigned on removal from Lae.
1986	
February	Second occupant of the post of Library Assistant (Microfilm) commenced work (Mr Peter Nagai).
	First release of microfiche to the Matheson Library.
	First publication on microfiche offered for sale by the Matheson Library ("The Times of Papua New Guinea", 1983-1985).
	Technical assistants on staff of Audio Visual Unit started to assist with retrospective microfilming of newspapers as work load in the Unit permitted.
March-September	Project hampered by series of technical problems involving camera, film processor and microfiche duplicator.
June	Member of staff of Audio Visual Unit (Mr Kepogameng Taho) took over operation of 16mm microfilm processor from the author.
	Second camera commissioned (Bell & Howell Filemaster II).
	Microfilming for administration started using above camera.
July	Microfilm jacket reader-filler commissioned.
September	Author resigned from post of Audio Visual Officer in the Matheson Library to return to United Kingdom on completion of three-year contract.

APPENDIX 2

NAMES AND ADDRESSES OF SUPPLIERS OF EQUIPMENT AND MATERIALS

Advance Electronics P.O. Box 230, Wrexham, Clwd, LL14 3JR, United Kingdom	Tel: 9078 821000 Telex: 61424
Bray Film Processors Milbaise Farm, Tower Hill, Chipperfield, Herts. WD4 9LH, United Kingdom	Tel: Hemel Hempstead (0442) 833321
Bulbman Inc P.O. Box 2918, Reno, NV, 89502, USA	Tel: (702) 329-5913 Telex: 755-980
Burns Philp Business Systems P.O. Box 75, Port Moresby, Papua New Guinea	Tel: 22 9206 Telex: BURPHIL NE22116 BURPHIL NE23021
Information Technology Systems (PNG) Pty Ltd P.O. Box 185, Port Moresby, Papua New Guinea	(No longer trading: *Bell & Howell* agents are now *Burns Philp* - see above.)
Keyan Industries Inc P.O. Box 183, Braintree, MA, 02184, USA	Tel: (617) 848-7636
Kodak (Australasia) Pty Ltd P.O. Box 90, Coburg, Vic. 3058, Australia	Tel: (03) 350 1222 Telex: KDKCOBG AA32184
Lae Photography Pty Ltd P.O. Box 384, Lae, Papua New Guinea	Tel: 42 1478 Telex: PHOTO NE42468
Macbeth, a Division of Kollmorgen Corporation P.O. Box 950, Newburgh, NY, 12550, USA	Tel: (914) 561-7300 Telex: 131406
Meridien Business Equipment Pty Ltd P.O. Box 2131, Lae, Papua New Guinea	Tel: 42 2869 Telex: BREWO NE44110
Micobra Corporation P.O. Box 1187, Hanover, MA, 02339, USA	Tel: (617) 871-2610 Telex: 294116 BOSTLX UR Att: Micobra

Microseal Corporation P.O. Box 46, Zion IL, 60099, USA	Tel: (312) 872-1666 Telex: 497-2185 Fax: (312) 872-3040
Molex Microfilm Products Inc P.O. Box 175, Inwood Station, New York, NY, 10034, USA	Tel: (212) 569-5340 (212) 569-5393
Motion Technology Corporation P.O. Box 2009, Aston, PA, 19014, USA	Tel: (215) 358-1600 Telex: 835-381
National Analysis Laboratory University of Technology, Private Mail Bag, Lae, Papua New Guinea	Tel: 43 4999 Telex: UTECH NE42428 Fax: 42 4067
Océ-Reprographics Ltd P.O. Box 196, Cheltenham, Vic., 3192, Australia	Tel: (03) 584 1011 Telex: OCEREP AA33349
Philips Export BV P.O. Box 218, 5600 MD Eindhoven, The Netherlands	Telex: 35000 NLEEVDE
Spicers - Paper Industries Division of James Hardie Paper and Packaging 82 Belmore Road, Riverwood, NSW, 2210 Australia	Tel: ( ) 534-5544 Telex: AA20793
Steamships Trading Company P.O. Box 85, Lae, Papua New Guinea	Tel: 42 1237 Telex: STEAM NE42423
Theodist Pty Ltd P.O. Box 1618; Boroko, Papua New Guinea	Tel: 25 6500 Telex: THEO NE22328
3M Australia Pty Ltd P.O. Box 684, Port Moresby, Papua New Guinea	Tel: 21 3816 Telex: TRIMCO NE23392 Fax: 21 3261
G.S. Wigg Pty Ltd 79 Port Road, Thebarton Adelaide, SA, 5031, Australia	Tel: ( ) 352-2422 Telex: AA89215

APPENDIX 3

PROPOSED ACCOMMODATION AND STAFFING FOR MICROFICHE PRODUCTION, MAY 1984

	ACTIVITY	LOCATION	STAFFING
1.	Issue of serials for filming	Serials Office	Serials Section
2.	Preparation of serials for filming	Discussion Room No. 2	Library (Temp.)
3.	Filming	Discussion Room No. 2	Library (Temp.)
4.	Film processing	Audio Visual Unit	Audio Visual Unit
5.	Film inspection	Discussion Room No. 2*	Library (Temp.)
6.	Rebinding of serials after filming (if required) and their return to serials office	Discussion Room No. 2	Library (Temp.)
7.	Film slitting	Discussion Room No. 2*	Library (Temp.)
8.	Design of headers	Serials Office	Serials Section
9.	Typing of headers	Library Office	Keyboard Operator
10.	Filming of headers (including trimming)	Audio Visual Unit	Audio Visual Unit
11.	Stripping-up Molex masters	Discussion Room No. 2*	Library (Temp.)
12.	Fiche duplication	Audio Visual Unit *	Audio Visual Unit
13.	Storage of Molex masters	Audio Visual Unit	Audio Visual Unit
14.	Storage of duplicate microfiche	PNG Collection	PNG Collection

* In the light of experience it may prove necessary for an isolated, dust-free environment to be provided for these activities.

APPENDIX 4

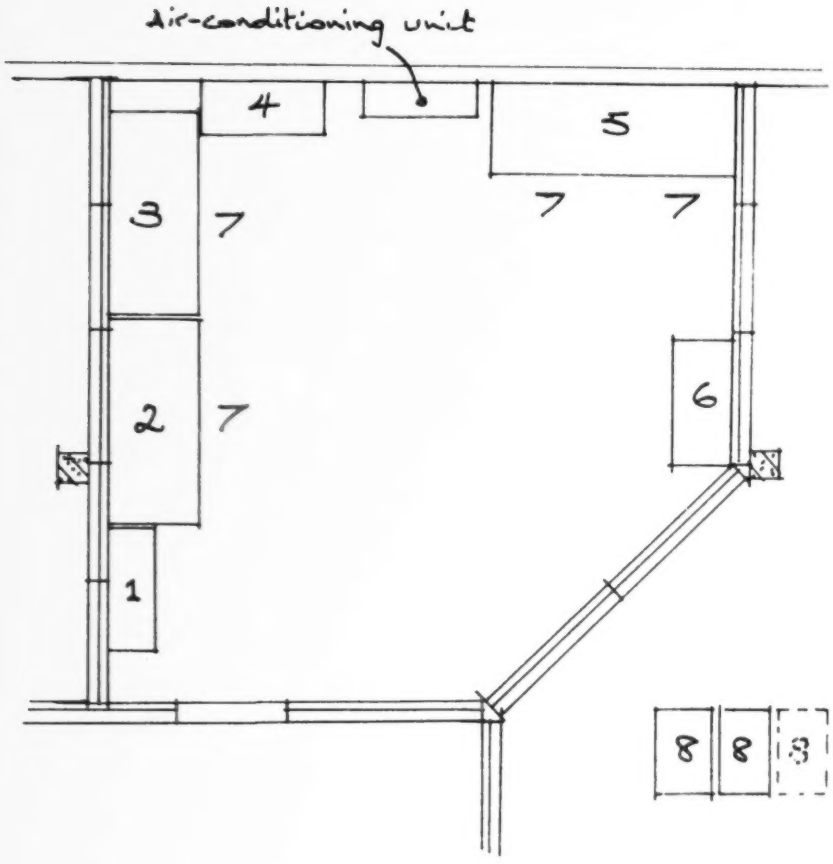
OPERATIONS PROPOSED TO BE CARRIED OUT AND FURNITURE REQUIRED IN DISCUSSION ROOM NO. 2, MAY 1984

1.	Storage of serials awaiting filming (until camera operator is ready to film a batch)	1	set of shelving 3ft wide x 6ft high x 1 ft deep. Shelves spaced at 1ft centres.
2.	Document preparation (including disbinding and rebinding if required)	1	table with drawer (for paper clip remover, stapler etc.) 60" x 27" x 27" (W x D x H)
3.	Filming	1	table with 2 drawers in pedestal at RHS (for camera head, unexposed film, targets etc.) 60" x 27" x 27" (W x D x H)
4.	Storage of serials after filming (until film has passed inspection)	1	set of shelving as at (1) above
5.	Film inspection, film slitting, stripping up of Molex masters	1	table with 1 drawer at LHS (for loupe, gloves etc.) and 1 drawer at RHS (for Molex grid, film cutter, gloves etc.) 78" x 27" x 27" (W x D x H)
6.	Storage of Molex materials, etc.	1	Metal cupboard (lockable) 36" x 18" x 76" (W x D x H)
7.	Chairs	4	typists chairs
8.	Storage of Molex masters and duplicate microfiche	2*	Microstor CF10 cabinets (each holds approx. 14,000 Molex masters or 18,000 duplicate fiche - in envelopes) * Initial quantity, to be added to as need arises.

APPENDIX 5

DISCUSSION ROOM NO. 2

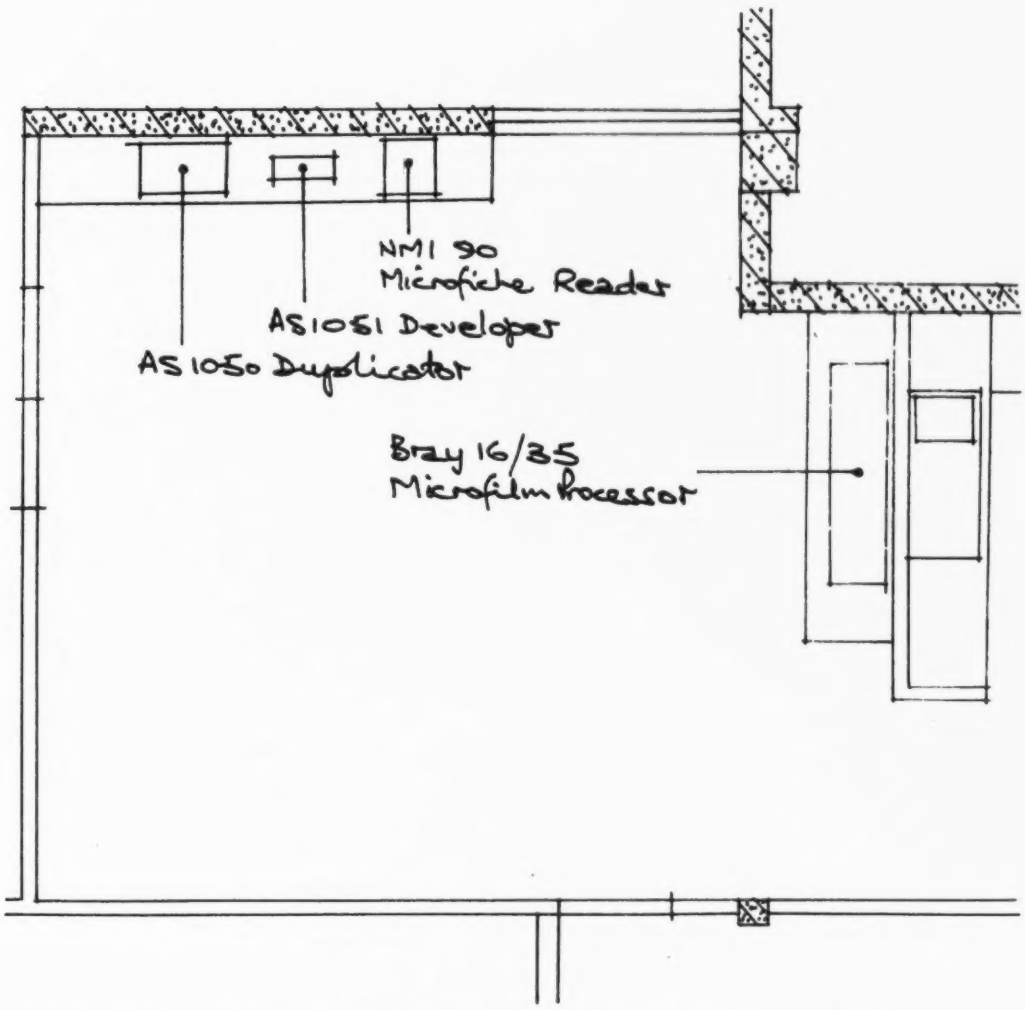
PROPOSED LAYOUT FOR MICROFICHE PRODUCTION, MAY 1984



DISCUSSION ROOM No 2 – PROPOSED LAYOUT for MICROFICHE PRODUCTION
Scale 1:50
11th May 1984

APPENDIX 6

LAYOUT OF MICROFICHE PRODUCTION EQUIPMENT
IN WORKROOM AREA OF AUDIO VISUAL UNIT



LAYOUT of MICROFICHE PRODUCTION EQUIPMENT
IN WORKROOM AREA of AUDIO VISUAL UNIT
Scale 1:50

APPENDIX 7

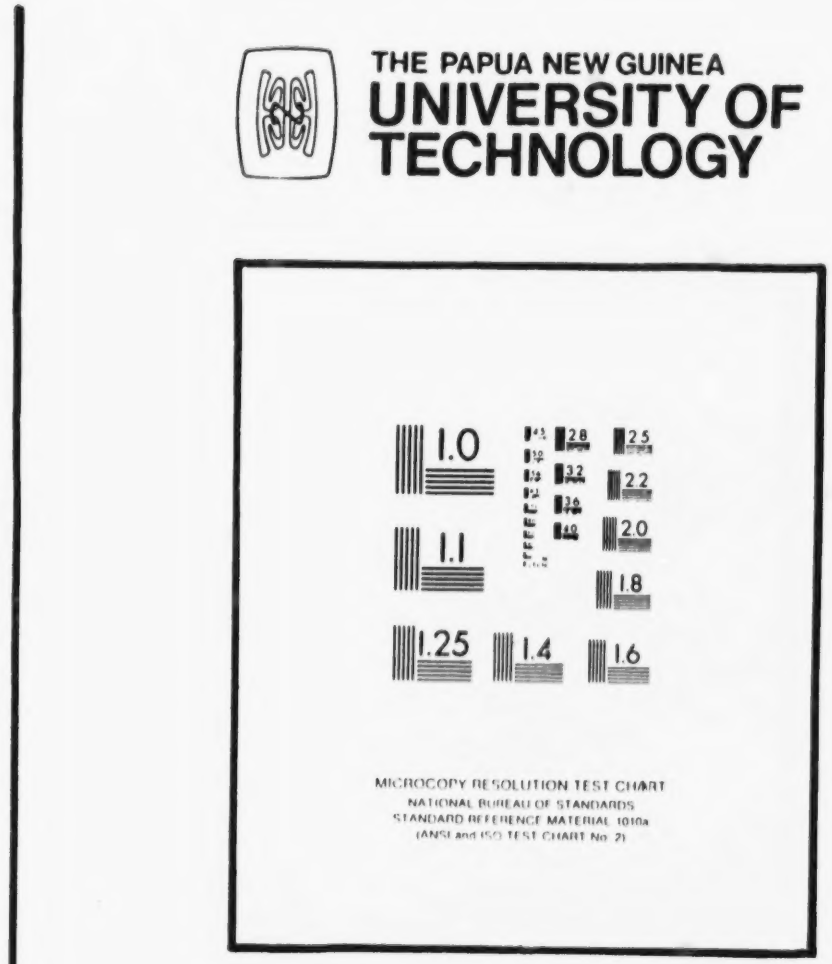
PRODUCTION RECORD FORM USED IN THE PROJECT

ROLL No: 86	*SHEET No:* 314
Type of film: Kodak 1460	Date processed: 4 Jul 86
Date(s) exposed: 2/3 Jul 86	Processor speed: 20
Exposure setting: 10	Developer temp: 30°C
Date serials forwarded to PNG Collection: 10 Jul 86	

Doc. No.	Title of serial	Redn. Ratio
2307	The Times of Papua New Guinea, Week Starting 9 June 1985, No. 285	29X
2308	" " 16 June 1985, No. 286 (1/2, 2/2)	"
2309	Papua New Guinea National Gazette, 1 August 1985, No. G42	21X
2310	The Reporter, 26 July 1985, 27/85	"

APPENDIX 8

TARGET PRECEDING DOCUMENT FILMED AT REDUCTION RATIO OF 21X



APPENDIX 9

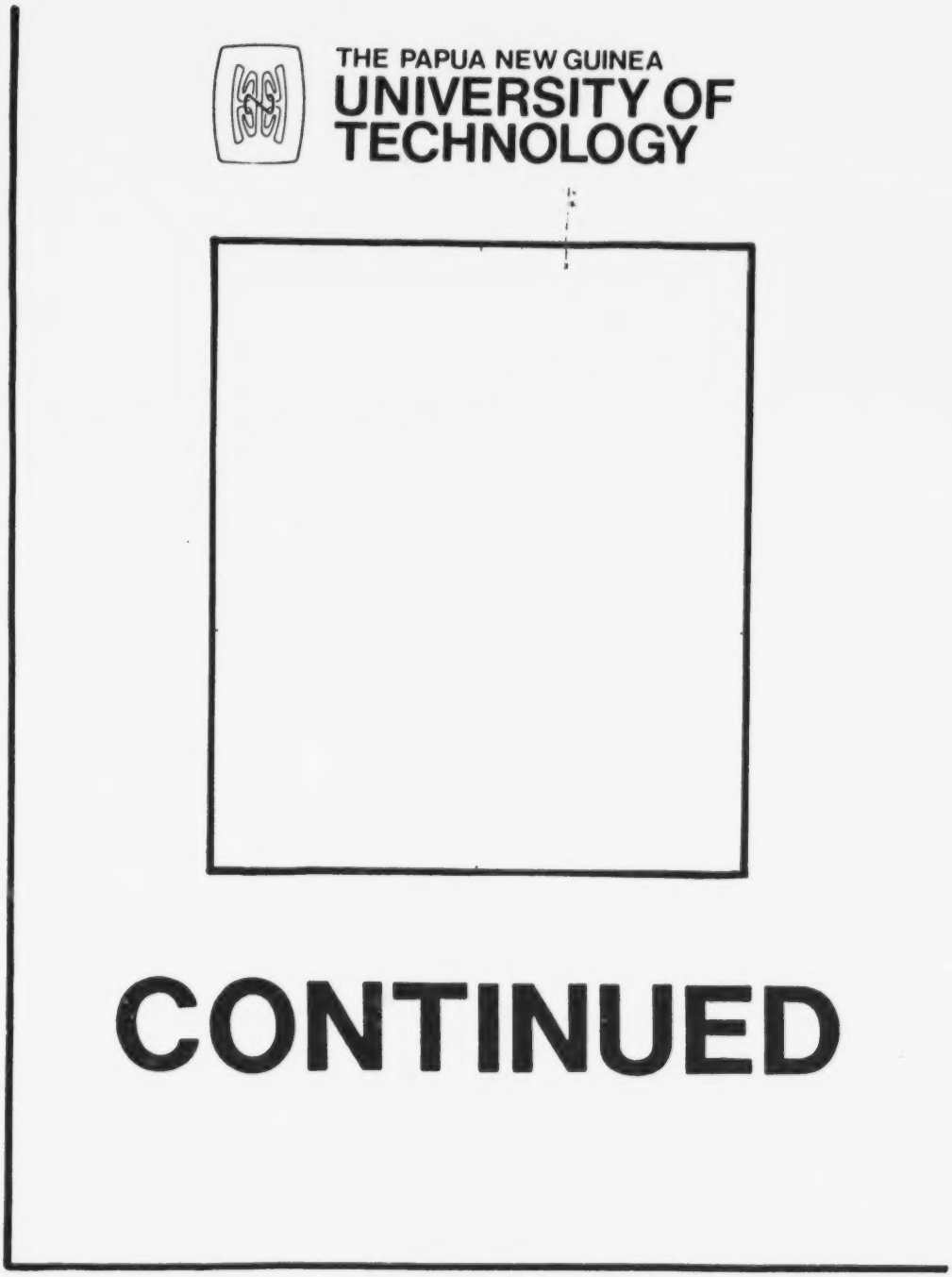
TARGET FOLLOWING DOCUMENT

THE PAPUA NEW GUINEA
UNIVERSITY OF
TECHNOLOGY

END

APPENDIX 10

TARGET AT END OF MICROFICHE
CONTINUED ON A FURTHER MICROFICHE



APPENDIX 11

MICROFILMING PROCEDURE

(NOTICE POSTED ALONGSIDE MICRO AUTO 16 CAMERA)

MINOLTA MICRO AUTO 16 CAMERA

MICROFILMING PROCEDURE

CHECK

. Is camera loaded with film?
. Is lens cap removed?
. Are room lights switched off?
. Is reduction ratio correctly set for first document?
. Is exposure setting correctly set?

ROLL SEQUENCE

Leader:	. 200 blank frames
Grey Scale:	. Exposure settings 1-12 followed by 5 blank frames
Documents:	. Precede each document with appropriate Reduction Ratio target . Follow each with appropriate END target and 11 blank frames
Trailer:	. Stop when buzzer sounds at end of roll (if not completing roll allow 100 frames)

AH/dm
20-9-85

APPENDIX 12

OPERATION OF PROCESSOR

(NOTICE POSTED ALONGSIDE BRAY 16/35 MICROFILM PROCESSOR)

BRAY 16/35MM MICROFILM PROCESSOR

TO OPERATE PROCESSOR

1. Plug in mains lead to socket on wall and switch on at socket.

2. On processor switch on the following in given sequence:

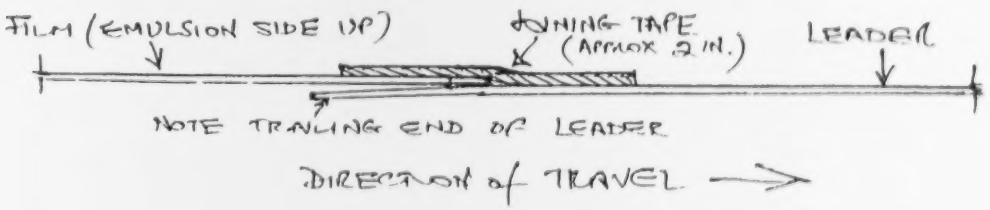
   POWER
   RECIRCULATION *
   HEATERS *
   DRYER

3. Turn developer and fixer thermostat controls at rear of machine until DEV and FIX green lights just come on.

4. Turn on mains water supply to give correct spray wash (approx. ¼ turn).

5. Insert dial thermometer in developer tank. When temperature reaches exactly 30°C (32°C on Tel-Tru thermometer) (takes approx. 15 mins) turn back both developer and fixer thermostat controls to zero. Green lights will go off.

6. Splice end of exposed film to leader as shown in figure below. Apply tape to exposed film first. Use fresh tape (3M No. 850 - Metallic Silver) each time.

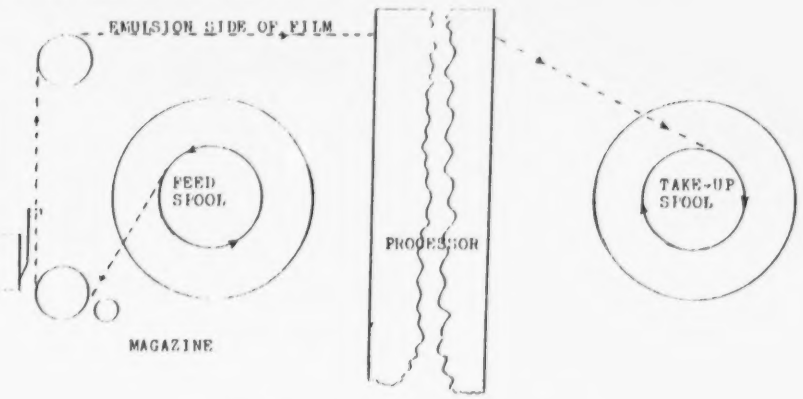


* Do not switch on RECIRCULATION or HEATERS with no solutions in tank.

...2/

APPENDIX 12 (continued)

7. Place spool of exposed film on magazine spindle, route film as in figure below and replace magazine lid.



FILM DIRECTION IN/OUT OF PROCESSOR

8. Check that developer temperature remains at 30°C (32°C on Tel-Tru Thermometer), remove thermometer from processor and close tank lid, set FILM SPEED to 15 and switch on DRIVE.

9. When the join between leader and processed film emerges from the processor separate the leader from the film and remove the leader spool from the take-up bracket. Replace with a white empty spool and attach processed film to this.

10. When the film has been processed the drive will stop automatically and buzzer will sound. Immediately attach a leader (or new film) to trailing end of exposed film and continue processing until only leader is left in machine.

    (NOTE: If length of film being processed is less than 50ft, two leaders will be required as first leader will not have fully emerged from machine when buzzer sounds.)

11. Switch off DRIVE, DRYER, HEATERS, RECIRCULATION and POWER switches in reverse order to starting up and switch off power at wall. Turn off mains water supply.

AH/dm
20-9-85

APPENDIX 13

PROCESSING SOLUTIONS

(NOTICE POSTED ALONGSIDE BRAY 16/35 MICROFILM PROCESSOR)

BRAY 16/35MM MICROFILM CAMERA

PROCESSING SOLUTIONS

Tank 1	DEVELOPER (approx. 6.5 litres) Add 800ml Kodak Microfilm Developer to 5.6 litres water (not the other way round) (1 + 7) and top up to approx. 12mm below overflow outlet with water.
Tank 2	RUNNING RINSE
Tank 3	FIXER (approx. 6.5 litres) Add 1.6 litres Kodak Microfilm Fixer to 4.8 litres water (1 + 3) and top up to approximately 12mm below overflow outlet with water.
Tank 4	RUNNING RINSE
Tank 5	SPRAY WASH
Tank 6	FINAL RINSE (approx. 2.5 litres) Add 5ml Kodak Photoflo to 2.5 litres water.
Tanks 7-10	DRYER

NOTES:

1. Every 2 weeks drain Developer tank, rinse with fresh water and refill with fresh developer.

2. Every 4 weeks drain Developer, Fixer and Final Rinse tanks, rinse with fresh water and refill with fresh solutions.

   Remove any debris that may accumulate in tanks, e.g., tape, film offcuts, etc.

   Check sponges and squeegees on rack 11. Sponges must be clean; squeegees must only just touch and not overlap.

3. Every 6 months remove leader from machine (use OVERRIDE switch), drain all solutions, remove all racks and clean all tanks. Replace leader and racks and refill with new solutions.

4. In the event of power failure switch off all switches in the normal sequence. Then assess the situation to see if any film in the processor can be saved.

APPENDIX 14

RECORD SHOWING USE OF PROCESSING SOLUTIONS

(NOTICE POSTED ALONGSIDE BRAY 16/35 MICROFILM PROCESSOR)

DATES SOLUTIONS MADE UP			*FILMS PROCESSED*		
Dev.	Fix.	Final rinse	Date	No. of rolls	Rolls this mix of developer
2Sep 86	2Sep 86	2Sep 86	2Sep86	2	2
			3 "	1	3
			5 "	2	5
			9 "	1	6
			11 "	1	7
			12 "	2	9
16Sep86			16Sep86	1	1
			18 "	2	3

APPENDIX 15

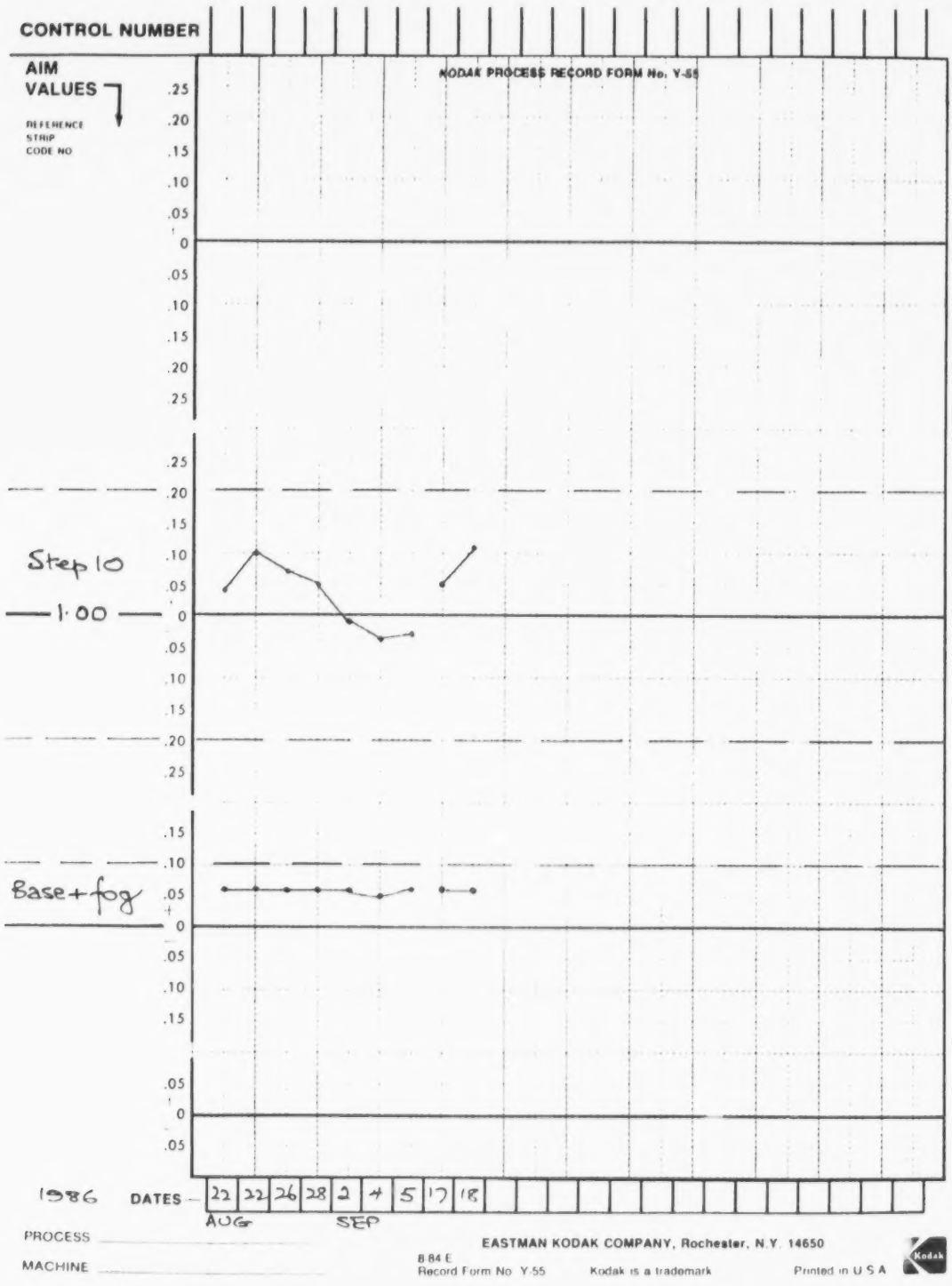
QUALITY CONTROL RECORD FORM USED IN THE PROJECT

Camera:	Micro Auto 16 / ~~Filemaster II~~				
Film unit:	Standard / ~~Special / LH / RH~~				
Film:	Kodak 1460 polyester / ~~7460 acetate~~				
Date	2Sep86				
Roll No.	95				
Batch	535131				
Remarks	New dev.				
D-max	2.17				
1	2.14				
2	2.08				
3	2.00				
4	1.83				
5	1.74				
6	1.61				
7	1.44				
8	1.23				
9	1.06				
10	0.90				
11	0.56				
12	0.32				
Base+fog	0.06				
"End"	0.98				
Pattern resolved	6.3				
at R.R.	29x				
l.p.mm.	183				
Gate	A few whiskers				
Scratches	O.K.				

APPENDIX 16

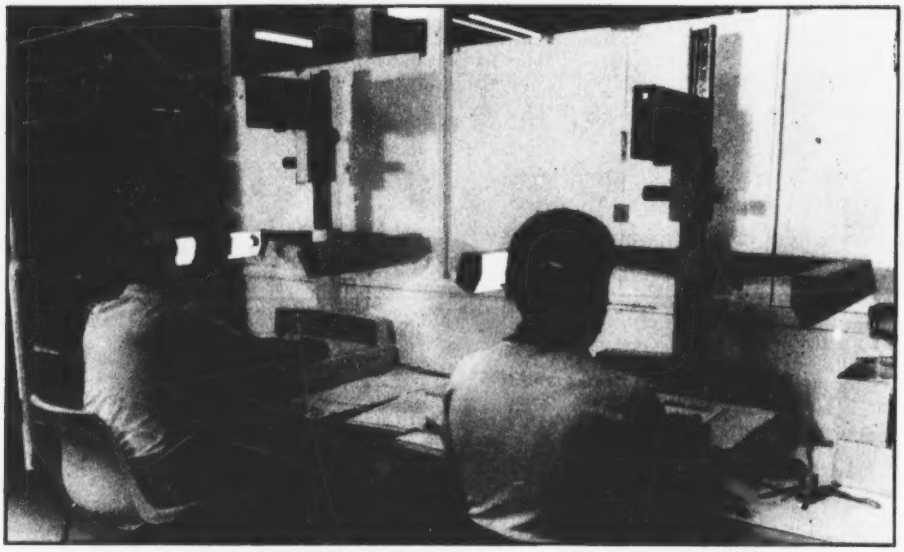
KODAK PROCESS RECORD FORM NO. Y-55

AS USED FOR MONITORING CAMERA AND FILM PROCESSOR PERFORMANCE

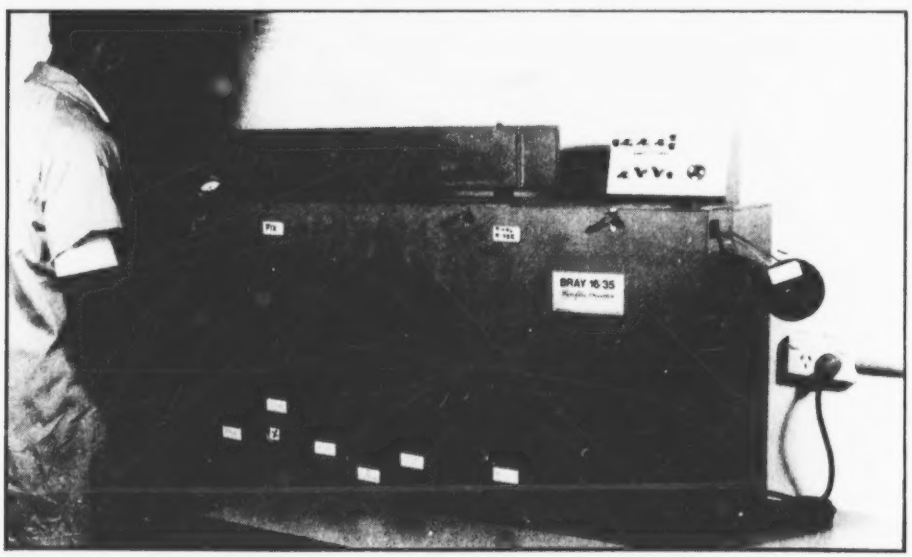


APPENDIX 17

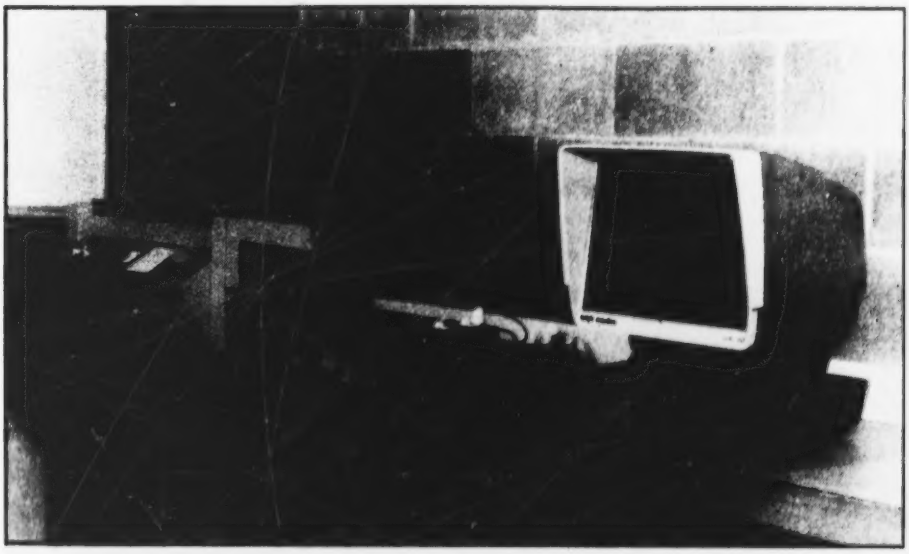
PHOTOGRAPHS OF THE PROJECT



1. Filming in progress using Bell & Howell Filemaster II (left) and Minolta Micro Auto 16 (right)

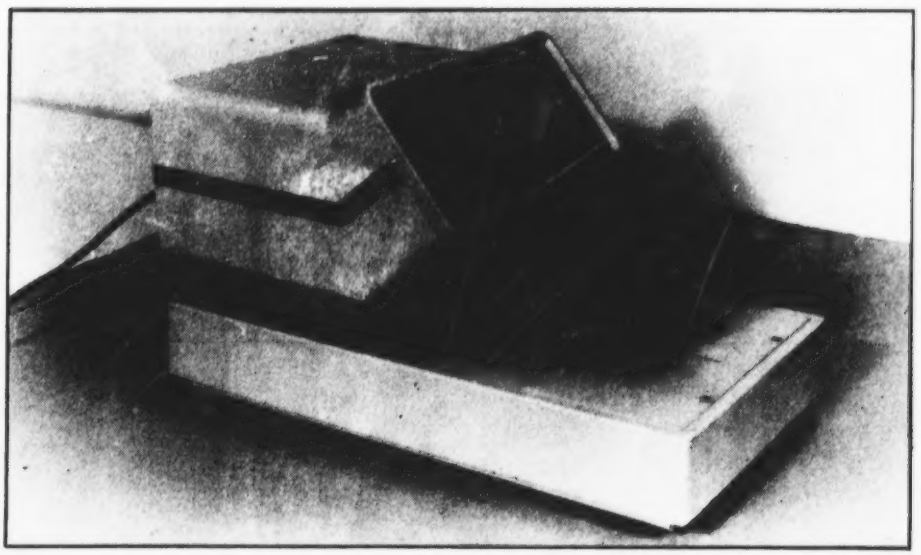


2. Checking developer temperature on Bray 16/35 Microfilm Processor



3. Equipment for microfiche duplication (from left to right: AS1050 Printer, AS1051 Developer, NMI 90 Microfiche Reader)

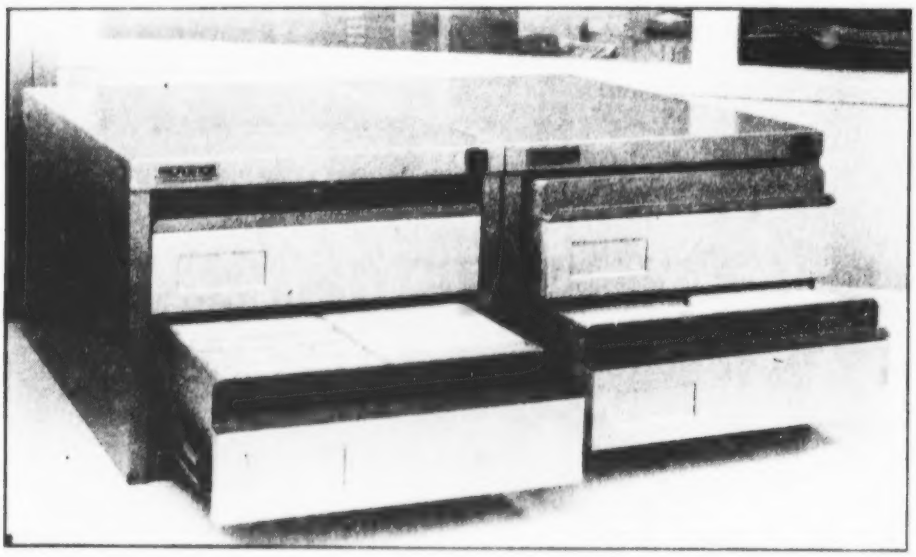
4. Checking quality of microfiche duplicate by visual inspection



5. Macbeth TD929 Densitometer - used for quality control

6. Film inspection using Keyan Filmcheck
Film Illuminator with 10X loupe

7. Microfilm jacket loading using Bell & Howell ABR 400



8. Completed microfilm jackets in storage cabinets (Microstor CF2)